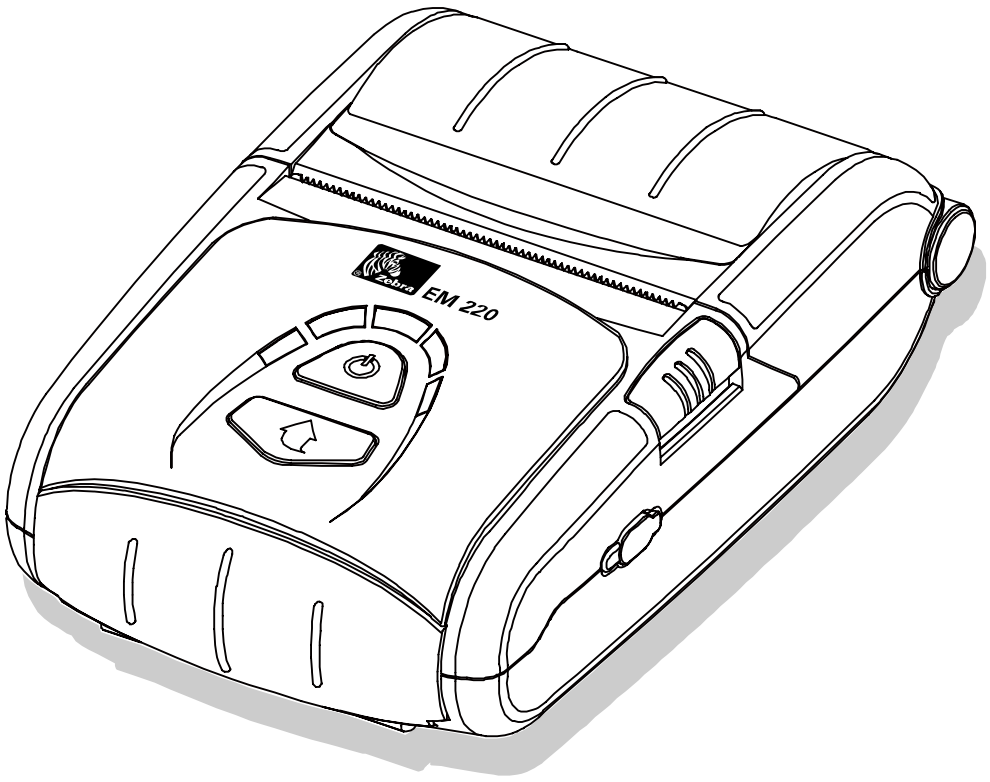
# EM 220

## Mobile Printer Service Manual

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# 1. Proprietary Statements

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## Product Improvements

Since continuous product improvement is a policy of Zebra Technologies Corporation, all specifications and signs are subject to change without notice.

## FCC Compliance Statement

NOTE: This equipment has been tested and found to comply with the limits or a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

• Reorient or relocate the receiving antenna.
• Increase the separation between the equipment and receiver.
• Connect the equipment into an outlet or circuit different from that to which the receiver is connected.
• Consult the dealer or an experienced radio/TV technician for help.

WARNING: Exposure to Radio Frequency radiation. To conform to FCC RF exposure requirements this device shall be used in accordance with the operating conditions and instructions listed in this manual.
NOTE: This unit was tested with shielded cables on the peripheral devices. Shielded cables must be used with the unit to insure compliance.
Changes or modifications to this unit not expressly approved by Zebra Technologies Corporation could void the user's authority to operate this equipment.

## Canadian Compliance Statement

This Class B digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe B est conforme á la norme NMB-003 du Canada.
"IC:" before the equipment certification number signifies that the Industry Canada technical specifications were met. It does not guarantee that the certified product will operate to the user's satisfaction.

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## 1-1 Safety Precautions

1. Be sure that all of the built-in protective devices are replaced. Restore any missing protective shields.

2. When reinstalling the chassis and its assemblies, be sure to restore all protective devices including: nonmetallic control knobs and compartment covers.

3. Make sure that there are no cabinet openings through which people – particularly children – might insert fingers and contact dangerous voltages. Such openings include excessively wide cabinet ventilation slots and improperly fitted covers and drawers.

4. Leakage Current Hot Check:
   WARING: Do not use an isolation transformer during this test.
   Use a leakage-current tester or a metering system that complies with American National Standards Institute (ANSI C101.1, Leakage Current for Applications), and Underwriters Laboratories (UL Publications UL1410, 59.7).
   With the unit completely reassembled, plug the AC line cord directly into a 100VAC or 240VAC outlet of the Adaptor.
   With the unit's AC switch first in the ON position and then OFF, measure the current between a known Earth ground(metal water pipe, conduit, etc.) and all exposed metal part, including: metal cabinet, frame, and screw-heads and printer. The current measure should not exceed 0.1 milliamp. Reverse the power-plug prong in the AC outlet and repeat the test.

5. Design Alteration Warning:
   Never alter or add to the mechanical or electrical design of the ECR. Unauthorized alterations might create a safety hazard. Also any design changes or additions will void the manufacture's warranty.

6. Components, parts and wiring that appear to have overhead or that are otherwise damaged should be replaced with parts that meet the original specifications. Always determine the cause of damaged or overheating and correct any potential hazards.

7. Observe the original lead dress, especially near the following areas: sharp edges, and especially the AC and high voltage supplies. Always inspect for pinched, out-of-place, or frayed wiring.
   Do not change the spacing between components and the printed circuit board. Check the AC power cord for damage. Make sure that leads and components do not touch thermally hot parts.

8. Product Safety Notice:
   Some electrical and mechanical parts have special safety-related characteristics, which might not be obvious from visual inspection. These safety features and the protection they give might be lost if the replacement component differs from the original-even if the replacement is rated for higher voltage, wattage, etc.
   Components that are critical for safety are indicated in the circuit diagram by shading, ⚠ or ⚠.
   Use replacement components that have the same ratings, especially for flame resistance and dielectric strength specifications. A replacement part that does not have the same safety characteristics as the original might create shock, fire or other hazards.

## 1-2 Servicing Precaution

**WARNING 1: First read the Safety Precaution section of this manual. If some unforeseen circumstance creates a conflict between the servicing and safety precautions, always follow the safety precaution.**

**WARNING 2: An electrolytic capacitor installed with the wrong polarity might explode.**

1. Always unplug the unit's AC power cord from the AC power source or the Power Switch off before attempting to:
   (a) Remove or reinstall any component or assembly,
   (b) Disconnect an electrical plug or connector,
   (c) Connect a test component in parallel with an electrolytic capacitor.

2. Some components are raised above the printed circuit board for safety.
   An insulation tube or tape is sometime used.
   The internal wiring is sometimes clamped to prevent contact with thermally hot components.
   Reinstall all such elements to their original position.

3. After servicing, always check that the screws, components and wiring have been correctly reinstalled.
   Make sure that the portion around the serviced part has not been damaged.

4. Check the insulation between the blades of the AC plug and accessible conductive parts
   (example: metal panels and input terminals).

5. Insulation Checking Procedure: Disconnect the power cord from the AC source and turn the power switch ON. Connect an insulation resistance meter (500V) to the blades of the AC plug.
   The insulation resistance between each blade of the AC plug and accessible conductive parts (see above) should be greater than 1 mega-ohm.

6. Never defeat any of the B+ voltage interlock. Do not apply AC power to the unit (or any of its assemblies) unless all solid-state heat sinks are correctly installed.

7. Always connect an instrument's ground lead to the instrument chassis ground before connecting the positive lead; always remove the instrument's ground lead last.

## 1-3 Precaution for Electrostatically Sensitive Devices (ESDs)

1. Some semiconductor (solid state) devices are easily damaged by static electricity. Such components are called Electrostatically Sensitive Devices (ESDs); examples include integrated circuits and some field-effect transistors. The following techniques will reduce the occurrence of component damaged caused by static electricity.

2. Immediately before handling any semiconductor components or assemblies, drain the electrostatic charge from your body by touching a known earth ground. Alternatively, wear a discharging wrist-strap device. (Be sure to remove it prior to applying power-this is an Electric shock precaution.)

3. After removing an ESD-equipped assembly, place it on a conductive surface such as aluminum foil to prevent accumulation of electrostatic charge.

4. Do not use freon-propelled chemical. These can generate electrical charges that damage ESDs.

5. Use only a grounded-tip soldering iron when soldering or unsoldering ESDs.

6. Use only an anti-static solder removal device. Many solder removal devices are not rated as anti-static; these can accumulate sufficient electrical charge to damage ESDs.

7. Do not remove a replacement ESD from its protective package until you are ready to install it. Most replacement ESDs are packaged with leads that are electrically shorted together by conductive foam, aluminum foil or other conductive materials.

8. Immediately before removing the protective material from the leads of a replacement ESD, touch the protective material to the device will be installed.

9. Minimize body motions when handling unpacked replacement ESDs. Motions such as brushing clothes together, or lifting a foot from a carpeted floor can generate enough static electricity to damaged an ESD.

## 1-4 Operational Precautions

1. The heating element of the printer mechanism's thermal head and the driver IC are easily damaged. Never allow these components to come into contact with metal or other hard objects.

2. Never touch the printer mechanism's heating element with your hand. Doing so can damage the heating element and affect proper operation.

3. The head and motor areas are very hot during and immediately after printing. Do not touch components in these areas directly with your hand.

4. Do not use any paper other than these specified in this manual otherwise print head reliability and print quality are affected adversely.

5. Thermal paper starts to color at around 70ºC. Take care to protect unused and printed thermal paper against the affects of heat, light and characters on the paper to feed.

6. Take the roll paper out of the printer when you will not use the printer for a long time in a high temperature and humidity environment.

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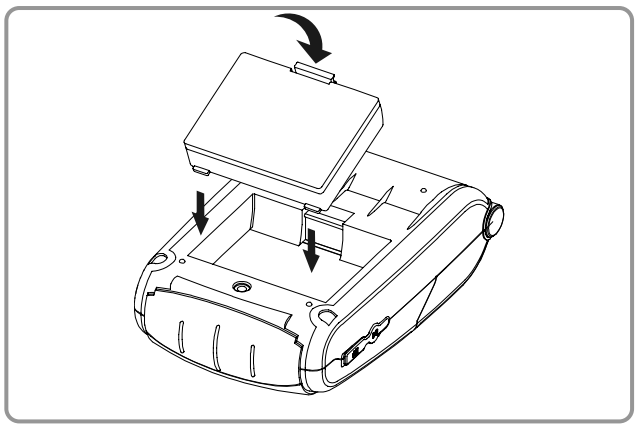
# 2. Installation and Usage

## 2-1 Battery Installation



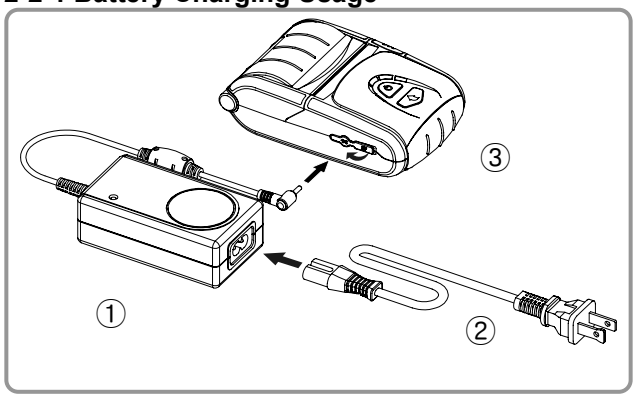
1) Insert the battery on the rear side of the printer, aligning the battery hook properly.

2) Push the battery into the slot until a snapping sound is heard.

***NOTE***
As the battery is not charged at the time of purchase, charge the battery prior to product use.
(Use the battery charger and/or the optional battery holder.)

## 2-2 Battery Charging

**2-2-1 Battery Charging Usage**




1) Turn off the printer power.

2) Connect the power cord ② to the battery charger ①.

3) Open the Interface Cap ③.

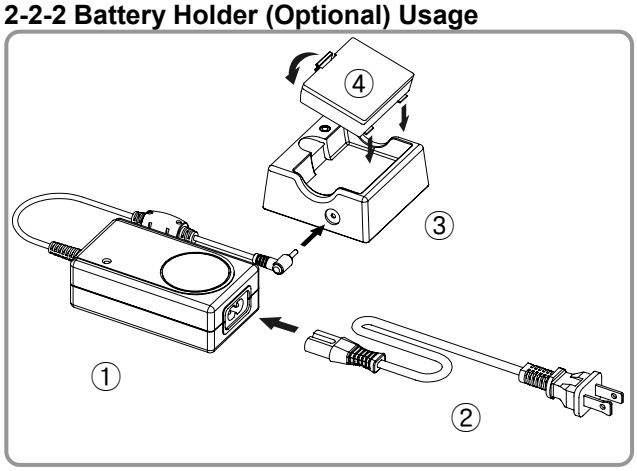
4) Connect the battery charger ① to the power connector of the printer.

5) Plug the power cord ② into an electrical outlet.

***CAUTION***
The printer may incur serious damage if the battery charger provided by Zebra is not used. Zebra is not legally liable for any such damages. (The voltage and electrical current specifications of the printer and battery charger must match.)

***WARNING***
Turn off the power before charging the battery for the printer.

### 2-2-2 Battery Holder (Optional) Usage




1) Connect the power cord ② to the battery charger ①.

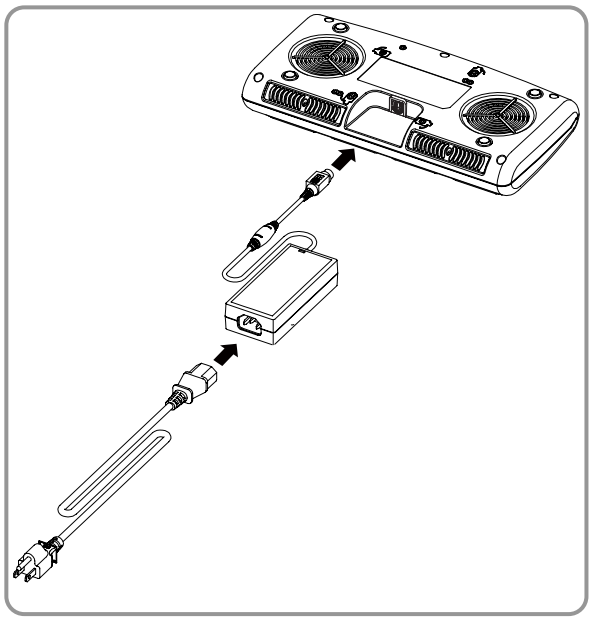
2) Connect the battery charger ① to the power connector of the battery holder ③.

3) Plug the power cord ② into an electrical outlet.

4) Insert the battery ④ into the battery holder ③ until a snapping sound is heard.

### 2-2-3 EM Series Quad Charger (Optional) Usage

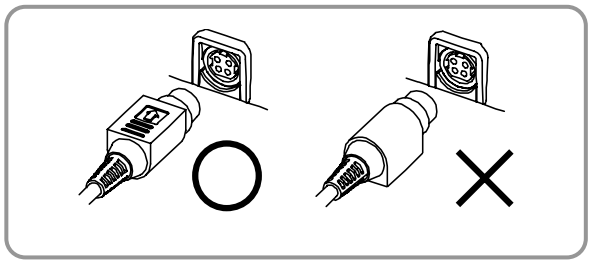
#### 2-2-3-1 Connecting the cables



1) Connect the power cord to the adaptor, and Connect the adaptor to the power connector of the Quad Charger.

2) Plug the power cord into a power Outlet. Input power is 100 ~ 240VAC, 50/60Hz, 1.4A.

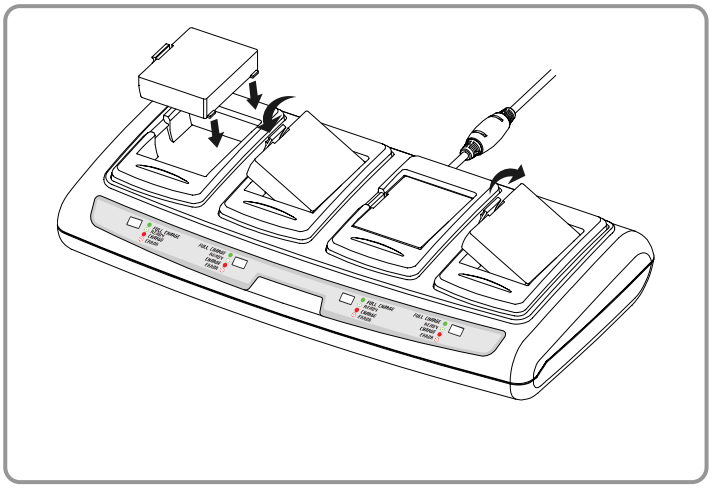
***NOTE***
When power is supplied, the amber and green LED turn on for two seconds.



***WARNING***

Use only designated AC/DC adaptor (12VDC, 5A)

### 2-2-3-2 Battery Charging



1) Fasten batteries via the battery hooks into the Quad Charger as shown above.

2) Push the battery in until a snapping sound is emitted.

3) Charging begins as soon as the battery is completely inserted. Batteries are charged to 8.4VDC, 0.8A.

4) Push the hook and pull up to extract the battery.

***NOTE***

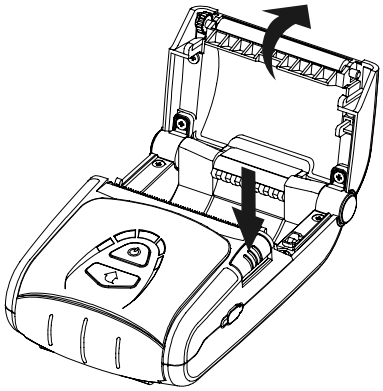
Battery charging status descriptions are as follows.

| LED | Charging Status | Charge Time |
|---|---|---|
| Red LED On | Charging | 2.5 hours |
| Green LED Blinking | Over 80% Charged | |
| Green LED On | Fully Charged | |
| Red LED Blinking | Error<br>Replace or Reinstall Battery | |

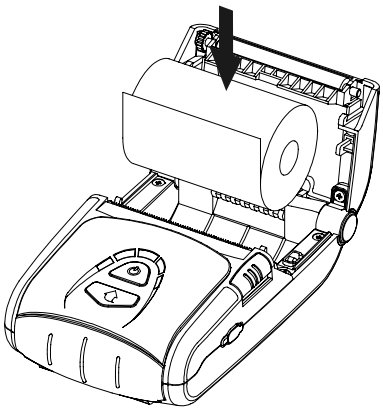
***CAUTION***

If the red LED is blinking, try removing and then reinserting the battery.
If the red LED continues to blink, please consult the reseller.

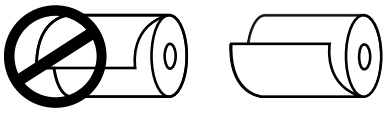
## 2-3 Paper Installation



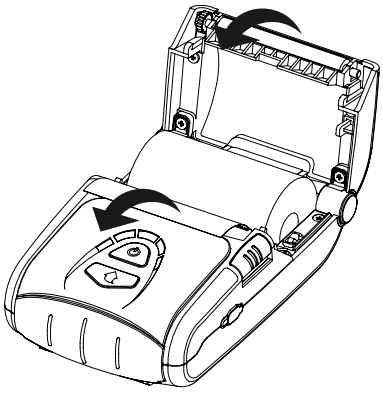
1) Press the Open button to open the paper cover.



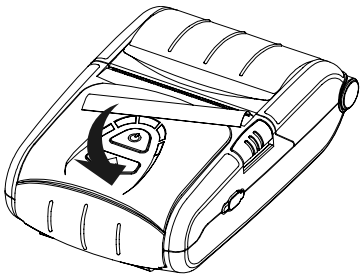
2) Insert the paper as shown in the image.
(Remove any remaining core of a fully used paper roll.)



3) Ensure that you to align the paper correctly.

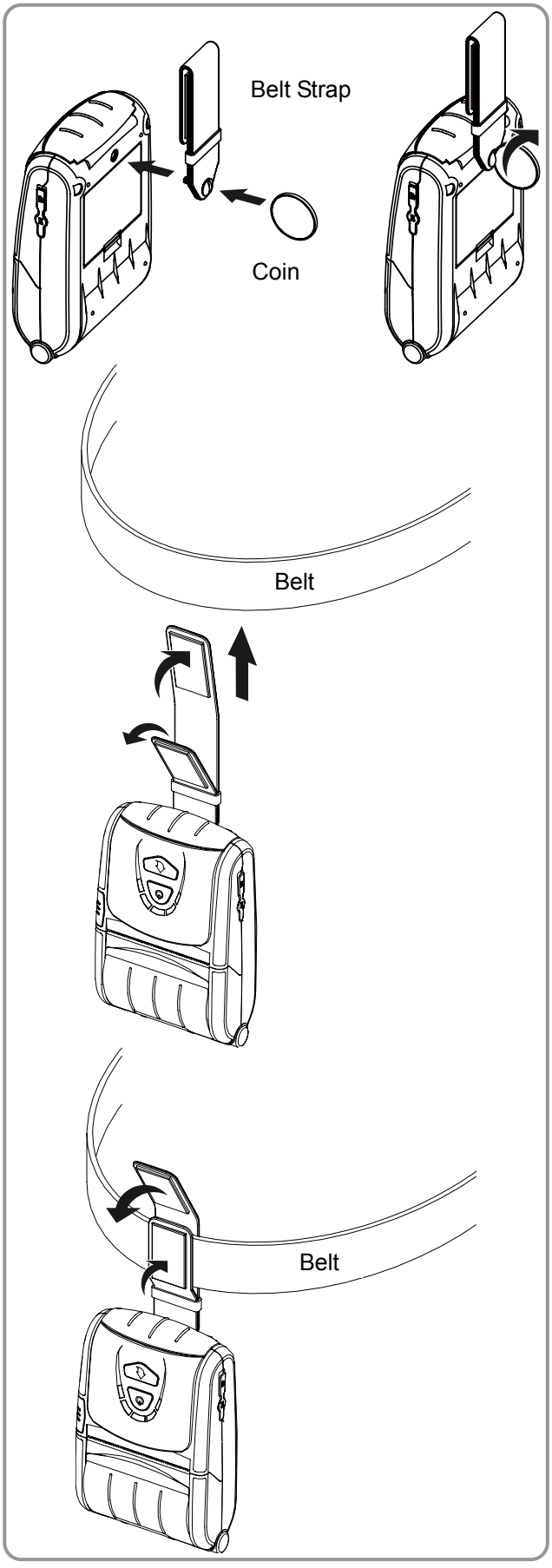


4) Pull the paper out as shown in the image and close the paper cover.



5) Tear off any excess paper in the direction of the side of the printer.

## 2-4 Belt Strap Usage




1) Insert the belt strap screw into the belt strap hole.

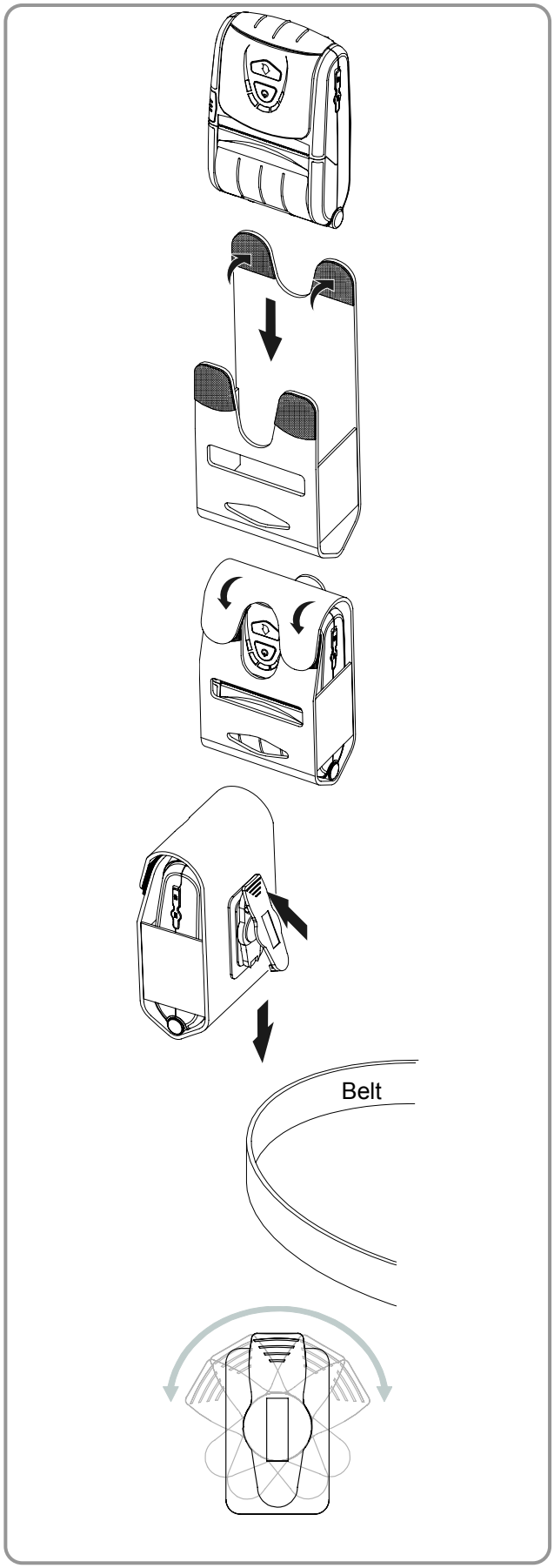
2) Use a coin to tighten the belt strap screw as shown in the image.

3) Undo the belt strap Velcro.

4) Fasten the belt strap to a belt.

5) Close the Velcro as shown in the image.

## 2-5 Leather Case (Optional) Usage




1) Undo the Velcro.

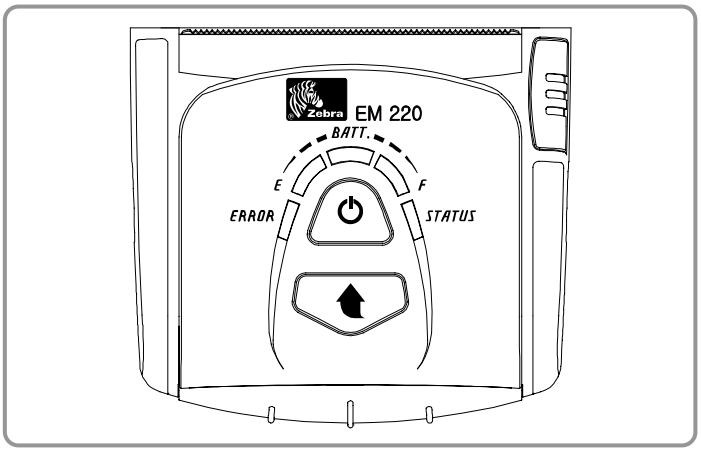
2) Place the printer into the leather case following the direction shown in the image.

3) Close the Velcro.

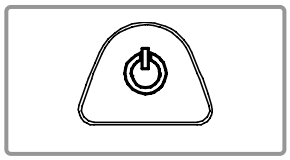
4) Affix to a belt using the clip at the rear of the case.

***NOTE***
The clip on the leather case can be rotated two stages by 30° per stage(maximum 60°).

## 2-6 Control Panel Usage

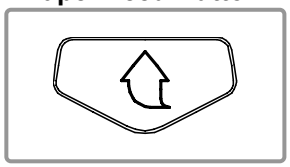



**• Power Button**



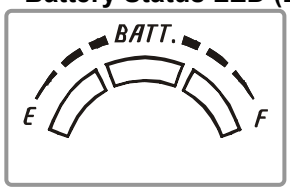
This button is used to turn the printer on and off.
When the printer is off, pressing this button for approximately 2 seconds will turn the power on. When the printer is on, pressing this button for approximately 2 seconds will turn the power off.

**• Paper Feed Button**



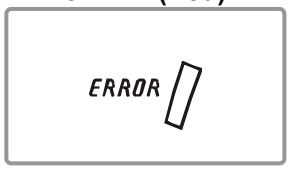
Paper output can be done manually by pressing this button.
In addition, self-testing and Hexadecimal Dumping can be done.
1) Refer to “2-10 Self-Test” for self-test information.
2) Refer to the service manual regarding Hexadecimal Dumping.

**• Battery Status LED (Blue or Red)**



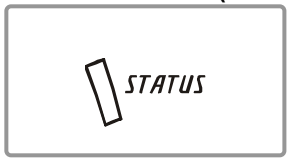

1) If three blue LEDs are lit, the battery is fully charged.
2) If two blue LEDs are lit, the battery is half charged.
3) If one blue LED is lit, the battery is at the lowest charge level.
4) If the red LED is lit, the battery must be charged or replaced.

**• Error LED (Red)**




1) If the red LED is lit, the paper cover is open.
2) If the red LED is blinking, either the paper has been fully used or the print head is overheated. (Fill with paper or turn the printer off for at least 10 minutes.)
3) If the red LED continues to blink, it may indicate a more serious problem with the product, and thus an authorized service dealer should be consulted.

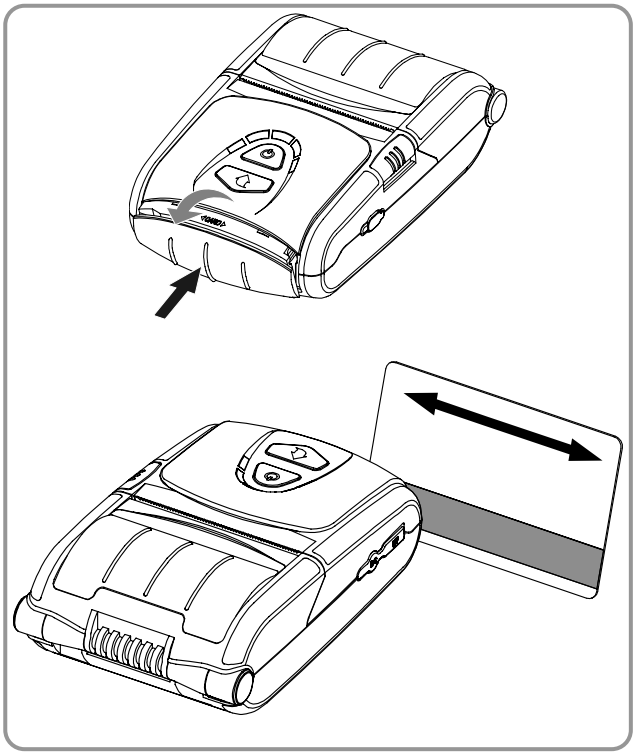
**• Bluetooth LED (Green)**




1) If the green LED turns on in unison with the battery status LED, the printer can be used with Bluetooth wireless communication.
2) If only the green LED is lit, the printer has entered the power saving mode.

***NOTE***
The power saving mode is activated after the first communication, with the default time interval being 10 seconds.

## 2-7 MSR Usage



1) Press the MSR cover to open.

2) Insert the card as shown in the image and swipe in the direction of the arrow.
(can be done in both directions)

3) When finished using, press the MSR cover to close it.

***NOTE***
If the card does not register, first check to see if it is properly aligned. When swiping the card, the recommended swiping speed is 100 ~ 1500 mm/sec.

## 2-8 Self-Test

Run the self-test when first setting the printer or when encountering a problem, and check the following:

- Control Circuit, Mechanisms, Print Quality, ROM Version, and Memory Switch Settings

If no issue is found with the printer after running the self-test, examine the other devices or peripherals and software. This function is independent of such other devices and software.

#### 2-8-1 Self-Test Instructions

1) Turn the printer power off and close the printer paper cover.
2) Pressing the paper feed button and power button simultaneously turns the printer on.
3) The printout is produced after releasing the two buttons.
4) To add a printout of the ASCII pattern, press the paper feed button once more.
5) After the ASCII pattern is printed out, the self-test is automatically terminated.

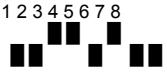
### 2-8-2 Self-Test Printout Sample

Boot loader version :
VER v2.01 20071005
Firmware version :
B01.00 STD 071108
Bluetooth Firmware version :
3.0.0
Bluetooth BD address :

001901223194
Auth. & Encry. are enable
Connection Mode = 2
==========
Butter Capacity : 128K Bytes
Print Density : 100%
Bluetooth Interface
- Baud rate : 115200 bps
Serial Interface
- Baud rate : 115200 bps
Data bits : 8 bits
Parity : None
Stop bit : 1 bit or more
Handshaking : DTR/DSR
Default Codepage : PC437
Print Speed : 80mm/s
Double byte character mode:Off
Busy printer buffer full
Font : 12 x 24
Paper out Bell : Off
Low Battery Buzzer : On
Power off time : 15 Min
Idle mode time : 10 Sec
Two Dimension Symbol :
- Selected PDF417 symbol
- Selected DATAMATRIX symbol
- Selected MAXI code symbol
- Selected QR code symbol
MSR read mode : Auto TRACK1/2/3

Memory switch setup status

Memory S/W1



1 2 3 4 5 6 7 8
ON
OFF

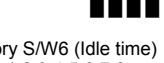
Memory S/W2

1 2 3 4 5 6 7 8
ON
OFF

Memory S/W3

1 2 3 4 5 6 7 8
ON
OFF

Memory S/W5 (Power off time)

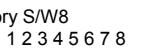


1 2 3 4 5 6 7 8
ON
OFF

Memory S/W6 (Idle time)

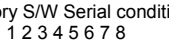
1 2 3 4 5 6 7 8
ON
OFF

Memory S/W7



1 2 3 4 5 6 7 8
ON
OFF

Memory S/W8

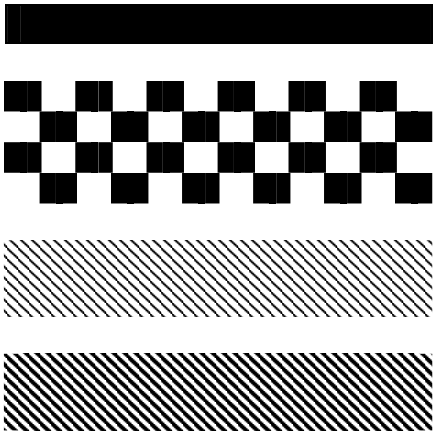


1 2 3 4 5 6 7 8
ON
OFF

Memory S/W Serial condition



1 2 3 4 5 6 7 8
ON
OFF



If you want to continue
SELF-TEST printing,
please press FEED button.

ASCII

```
!"#$%&'()*+,-./0123456789:;<=>?@
"#$%&'()*+,-./0123456789:;<=>?@A
#$%&'()*+,-./0123456789:;<=>?@AB
$%&'()*+,-./0123456789:;<=>?@ABC
%&'()*+,-./0123456789:;<=>?@ABCD
&'()*+,-./0123456789:;<=>?@ABCDE
'()*+,-./0123456789:;<=>?@ABCDEF
()*+,-./0123456789:;<=>?@ABCDEFG
)*+,-./0123456789:;<=>?@ABCDEFGH
*+,-./0123456789:;<=>?@ABCDEFGHI
+,-./0123456789:;<=>?@ABCDEFGHIJ
,-./0123456789:;<=>?@ABCDEFGHIJK
-./0123456789:;<=>?@ABCDEFGHIJKL
./0123456789:;<=>?@ABCDEFGHIJKLM
/0123456789:;<=>?@ABCDEFGHIJKLMN
0123456789:;<=>?@ABCDEFGHIJKLMNO
123456789:;<=>?@ABCDEFGHIJKLMNOP
23456789:;<=>?@ABCDEFGHIJKLMNOPQ
3456789:;<=>?@ABCDEFGHIJKLMNOPQR
456789:;<=>?@ABCDEFGHIJKLMNOPQRS
56789:;<=>?@ABCDEFGHIJKLMNOPQRST
6789:;<=>?@ABCDEFGHIJKLMNOPQRSTU
789:;<=>?@ABCDEFGHIJKLMNOPQRSTUV
89:;<=>?@ABCDEFGHIJKLMNOPQRSTUVW
9:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWX
```

PC437

```
ÇüéâäàåçêëèïîìÄÅÉæÆôöòûùÿÖÜ¢£¥Ptƒ
üéâäàåçêëèïîìÄÅÉæÆôöòûùÿÖÜ¢£¥Ptfá
éâäàåçêëèïîìÄÅÉæÆôöòûùÿÖÜ¢£¥Ptfáí
âäàåçêëèïîìÄÅÉæÆôöòûùÿÖÜ¢£¥Ptfáíó
äàåçêëèïîìÄÅÉæÆôöòûùÿÖÜ¢£¥Ptfáíóú
àåçêëèïîìÄÅÉæÆôöòûùÿÖÜ¢£¥Ptfáíóúñ
åçêëèïîìÄÅÉæÆôöòûùÿÖÜ¢£¥PtfáíóúñÑ
çêëèïîìÄÅÉæÆôöòûùÿÖÜ¢£¥PtfáíóúñÑª
êëèïîìÄÅÉæÆôöòûùÿÖÜ¢£¥PtfáíóúñÑªº
ëèïîìÄÅÉæÆôöòûùÿÖÜ¢£¥PtfáíóúñÑªº¿
èïîìÄÅÉæÆôöòûùÿÖÜ¢£¥PtfáíóúñÑªº¿ ┌
ïîìÄÅÉæÆôöòûùÿÖÜ¢£¥PtfáíóúñÑªº¿ ┌ ┐
îìÄÅÉæÆôöòûùÿÖÜ¢£¥PtfáíóúñÑªº¿ ┌ ┐ ½
ìÄÅÉæÆôöòûùÿÖÜ¢£¥PtfáíóúñÑªº¿ ┌ ┐ ½¼
ÄÅÉæÆôöòûùÿÖÜ¢£¥PtfáíóúñÑªº¿ ┌ ┐ ½¼¡
ÅÉæÆôöòûùÿÖÜ¢£¥PtfáíóúñÑªº¿ ┌ ┐ ½¼¡«
ÉæÆôöòûùÿÖÜ¢£¥PtfáíóúñÑªº¿ ┌ ┐ ½¼¡«»
æÆôöòûùÿÖÜ¢£¥PtfáíóúñÑªº¿ ┌ ┐ ½¼¡«»▓
ÆôöòûùÿÖÜ¢£¥PtfáíóúñÑªº¿ ┌ ┐ ½¼¡«»▓▒
ôöòûùÿÖÜ¢£¥PtfáíóúñÑªº¿ ┌ ┐ ½¼¡«»▓▒ │
öòûùÿÖÜ¢£¥PtfáíóúñÑªº¿ ┌ ┐ ½¼¡«»▓▒ │ ┤
òûùÿÖÜ¢£¥PtfáíóúñÑªº¿ ┌ ┐ ½¼¡«»▓▒ │ ┤ ╡
ûùÿÖÜ¢£¥PtfáíóúñÑªº¿ ┌ ┐ ½¼¡«»▓▒ │ ┤ ╡ ╢
ùÿÖÜ¢£¥PtfáíóúñÑªº¿ ┌ ┐ ½¼¡«»▓▒ │ ┤ ╡ ╢ ╖
ÿÖÜ¢£¥PtfáíóúñÑªº¿ ┌ ┐ ½¼¡«»▓▒ │ ┤ ╡ ╢ ╖
```

## 2-9 Hexadecimal dumping

This feature allows experienced users to see exactly what data is coming to the printer.
This can be useful in finding software problems. When you turn on the hexadecimal dump function, the printer prints all commands and other data in hexadecimal format along with a guide section to help you find specific commands.

• To use the hexadecimal dump feature, follow these steps:
1) Turn off the printer, remove the paper roll from the paper housing, and open the paper cover.
2) Hold down the FEED button while you turn on the printer.
3) Put the paper roll in the printer and close the paper cover.
4) Run any software program that sends data to the printer. The printer prints "Hexadecimal dump" and then all the codes are received in a two column format. The first column contains the hexadecimal codes and the second column gives the ASCII characters that correspond to the codes.

```
Hexadecimal Dump
To terminate hexadecimal dump
Press FEED button three times

1B 21 00 1B 26 02 40 40 . ! . . & . @ @
1B 25 01 1B 63 34 00 1B . % . . c 4 . .
41 42 43 44 45 46 47 48 A B C D E F G H

<Online Hex Dump Completed>
```

(A period(.) is printed for each code that has no ASCII equivalent.)

5) If the feed button is pressed 3 times., the printer finishes Hexadecimal dump mode, printing the message “Online Hex Dump Completed” on the paper.

# 2-10 Label Printing Function

### 2-10-1 Label Function Setting

Label paper and black mark paper available at the label mode

**• Setting Operations**

1) Turn on the printer power.
2) Open the paper cover and press and hold down the paper feed button for longer than two seconds.
3) After the buzzer tone is emitted, insert paper and close the cover.
4) Repeat the steps above to return to receipt mode.

**• Setting Via Memory Switch**

- Please refer to the memory switch changing section of the Commands Manual.

### 2-10-2 Auto Calibration Function

The label printing function requires the recognition of label paper gaps and black mark paper black bar in order to print.
If label paper gaps are not properly recognized, use the auto calibration function.

### •2-10-3 Auto Calibration Instructions

1) Turn the printer power off while in label print mode.
2) Press and hold down the paper feed button and then press the power button.
3) After the following printout is outputted, press the power button to perform auto calibration.

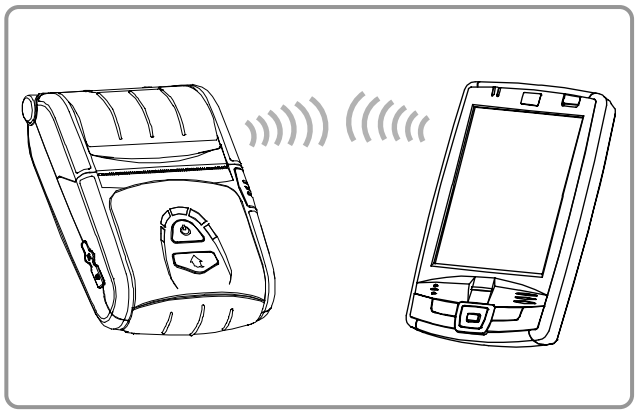
Select the mode
Auto Calibration: Power Button
Self Test: Feed Button

4) Three pages of label paper are outputted when performing auto calibration.

## 2-11 Peripherals Connection

This product can communicate with other devices via Bluetooth communication and cable.

### 2-11-1 Bluetooth Connection



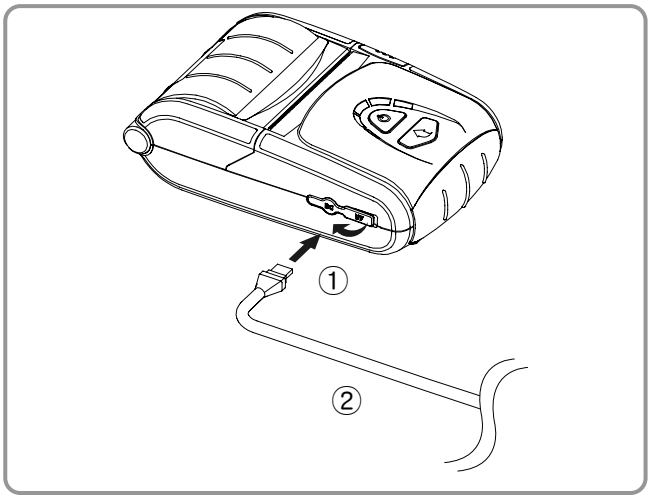
1) The printer can be connected to devices equipped with Bluetooth communication capacity (PDAs, PCs, etc.).

2) Use the Bluetooth connection function supported by the device to connect to the printer.

***NOTE***
Refer to the Bluetooth Manual for more details on connection.
You can check authentication, Encryption mode as well as connection mode of the Bluetooth from self test page.

***CAUTION***
**The Bluetooth connector located on the right side of the printer is for program downloading only. This connector is for service providers only.**

### 2-11-2 Interface Cable Connection




1) Open the Interface Cap ①.

2) Connect the interface cable (optional) ② to the cable connector of the printer.

***NOTE***
Use only cables (optional) provided by Zebra (USB, Serial).

3) Connect the interface cable to the USB port of the device (PDAs, PCs, etc.).

***NOTE***
The interface cable that can be connected with the printer is available in both USB and Serial type.
Refer to the service manual for detailed interface cable specifications.

# 3. Product Specifications

## 3-1 General Specifications

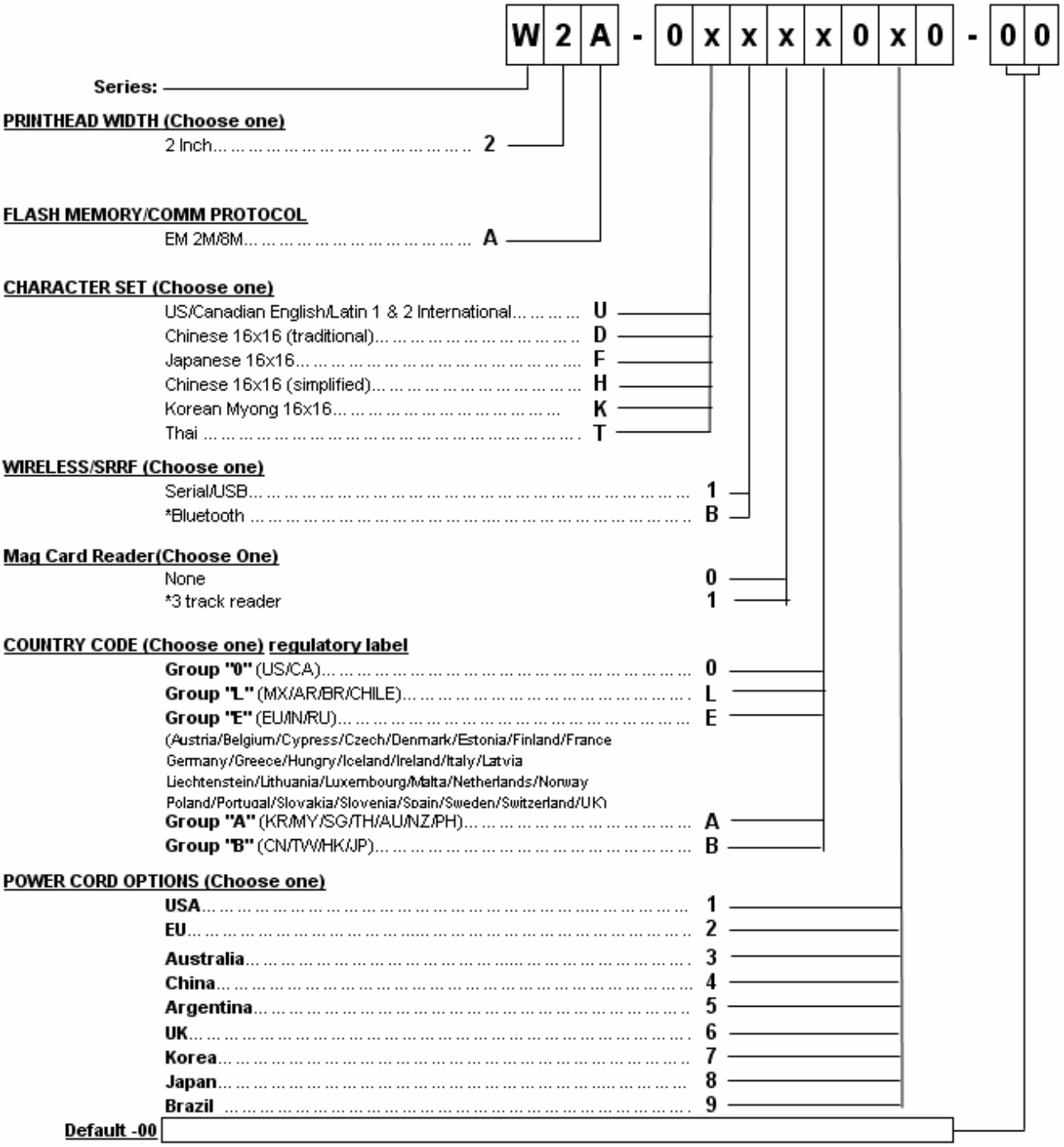
***NOTE***

Printer specifications are subject to change without notice.

| Item | | Description | | | |
|---|---|---|---|---|---|
| Product | Model | EM 220 (Refer to 3-2-1 Printer Classification) | | | |
| | Processor | S3C2410 (ARM920T) | | | |
| | Memory | • 29W160 (16Mbit flash memory), • K4S641632 (64Mbit SDRAM) | | | |
| | Interface | • Serial/USB, • Bluetooth Class2 V2.0 +EDR | | | |
| | Paper Supply Mode | Easy paper loading | | | |
| | Barcode | • 1 Dimension: UPC A, UPC E, CODE 39, CODE 93, Code 128, EAN 8, EAN 13, ITF, Codabar<br>• 2 Dimension: PDF417, MAXI, QR, Datamatrix | | | |
| | Emulation | BXL/POS | | | |
| | Driver | Windows 98 / ME / 2000 / NT 4.0 / XP / WEPOS / 2003 Server / VISTA | | | |
| | SDK | Windows 98 / ME / 2000 / NT 4.0 / XP / WEPOS / 2003 Server / VISTA / Windows CE 4.1 and later | | | |
| | Sensor | • Paper End: Reflection type photo sensor<br>• Paper Cover Open: Micro switch | | | |
| | Cutter Type | Tear-Bar | | | |
| | Dimensions | 79.5 × 126.7 × 43.6 mm (3.13 × 4.99 × 1.72″) | | | |
| | Weight | • Printer: 184g (0.41lbs.)<br>• Printer + Battery: 236g (0.52lbs.)<br>• Printer + Battery + Paper: 293g (0.65lbs.)<br>• Package: approx. 1000g (2.2lbs.) | | | |
| Printing | Method | Direct Thermal Line Printing | | | |
| | Direction | Uni-direction with friction feed | | | |
| | Speed | 80 mm/sec (3.15 in./sec) | | | |
| | Width | 48 mm (1.89″) | | | |
| | Line feed | 3.75 mm (0.15″) | | | |
| | Resolution | 203 DPI (Total dot count of horizontal direction: 384 dots) | | | |
| Character | Font type | Font KOR,CHN,JPN | Font A | Font B | |
| | Character structure | 24 x 24 dots | 12 x 24 dots | 9 x 24 dots | |
| | Character size | 3x3mm (0.12x0.12″) | 1.5x3mm (0.06x0.12″) | 1.125x3mm (0.044x0.12″) | |
| | Printing columns | 16 CPL (8.45 CPI) | 32 CPL (16.9 CPI) | 42 CPL (22.2 CPI) | |
| | Column interval | 3 mm (0.12″) | 1.5 mm (0.06″) | 1.125 mm (0.044″) | |
| | Line interval | 3.75 mm (0.15″, 30 dots) | | | |
| | Character spacing | 0.75 mm (0.03″, 6 dots) | | | |
| Firmware & character sets | Language type | Standard | Chinese | Japanese | Korean |
| | Firmware naming | Bxx.xx STD | Bxx.xx CHN | Bxx.xx JPN | Bxx.xx KOR |
| | Font A, B | 128x30pages | 128x20pages | | |
| | Language font | - | GB2312, BIG5 | Shift-JIS | KS5601 |
| | Common font | Alphanumeric: 95, International: 32 | | | |
| Paper | Paper Type | Thermal paper roll | | | |
| | Width | 58 ± 0.5 mm (2.28 ± 0.2″) | | | |
| | Diameter | Max. ø40 mm (1.57″) | | | |
| | Thickness | 0.06 ~ 0.10 mm (0.0024 ~ 0.0039″) | | | |
| Battery charger | Input | • Voltage: 100 ~ 250 VAC • Current: 0.5 A | | | |
| | Output | • Voltage: 8.4 VDC • Current: 0.8 A | | | |
| Battery pack | Type | Lithium-ion | | | |
| | Output | • Voltage: 7.4 VDC (Operating Range: 8.4 ~ 6.8 VDC)<br>• Capacity: 1200 mAh | | | |
| | Charging time | 2.5 hours | | | |
| Reliability | TPH | 120 km | | | |
| | Battery | Rechargeable up to 500 times | | | |
| | Drop test condition | • Drop directions: 1 corner, 3 edges and 6 surfaces. (10 drops)<br>• Product drop height: 1.2m (Approx. 4ft.)<br>• Packing drop height: 0.76m (Approx. 2.5ft.) | | | |
| Usage Conditions | Temperature | • Printer: -10~50℃ (14~122°F), • Battery: 0~40℃ (32~104°F) | | | |
| | Humidity | • Printer: 10~90% RH (No condensation)<br>• Battery: 20~70% RH (No condensation) | | | |
| Accessories | Model | P100xxxx : Refer to 3-3-1 Accessories Classification | | | |
| | Basic Package | Battery, Battery charger, Belt strap, Cleaning pen | | | |
| | Sold Separately | Battery, Battery cradle, Leather case, Interface cable, EM Series Quad charger, Wall mount (for EM Series Quad charger) | | | |

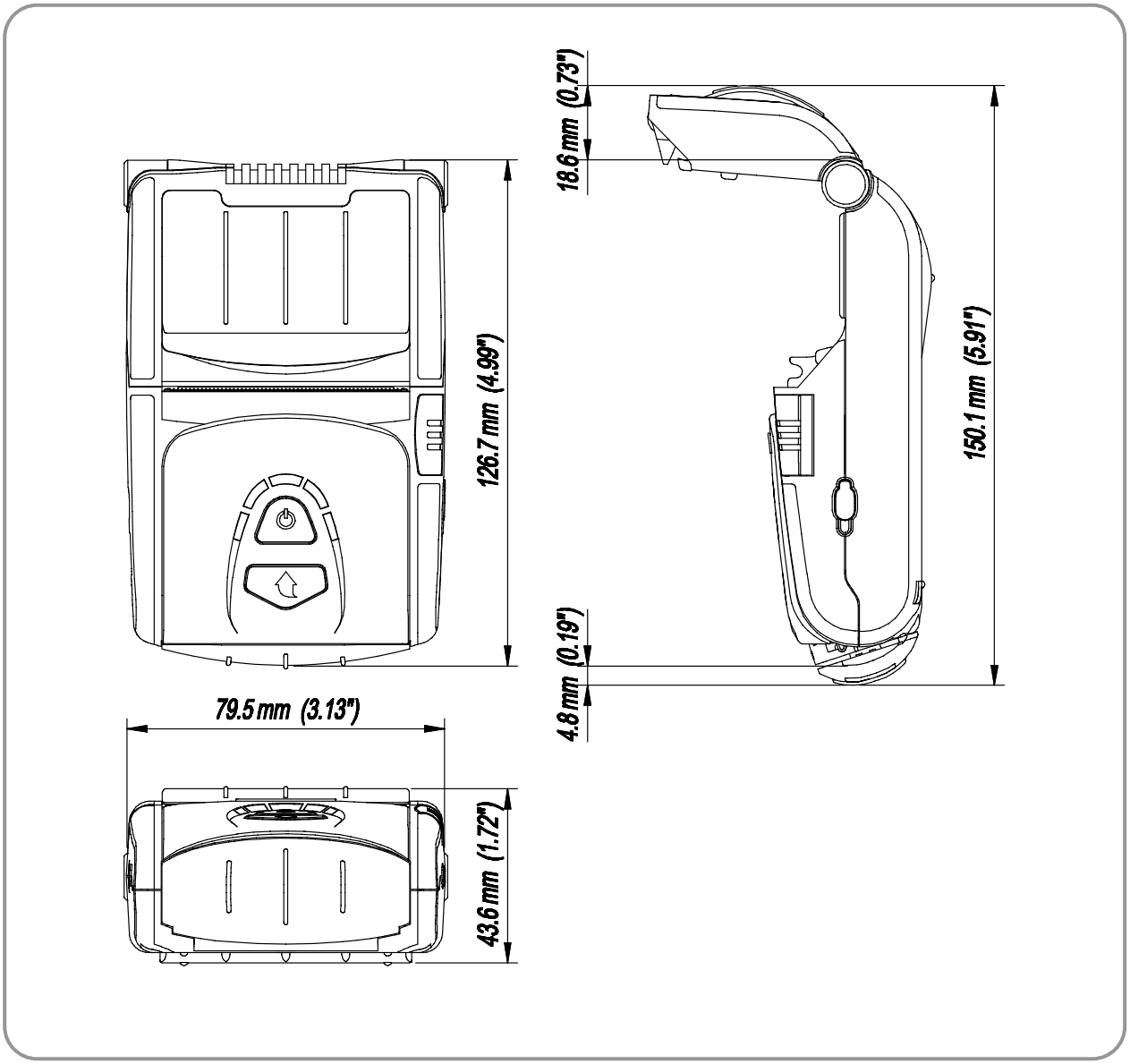
## 3-2 Printer Specifications

### 3-2-1 Product Configurator – EM series



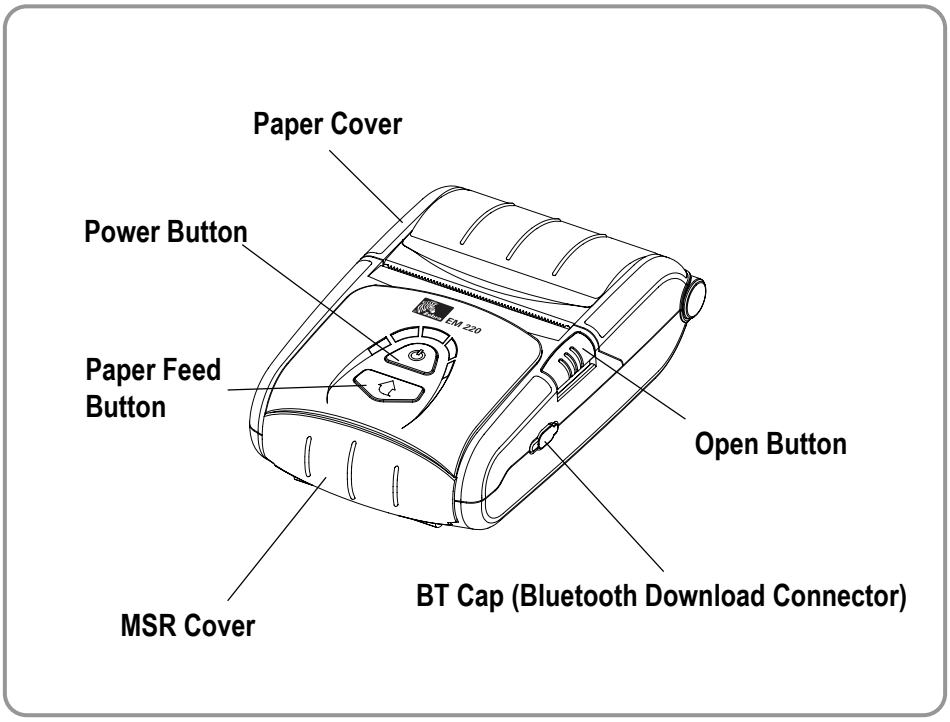
### 3-2-2 Printer Appearance

3-2-2-1 Printer Dimensions (mm)

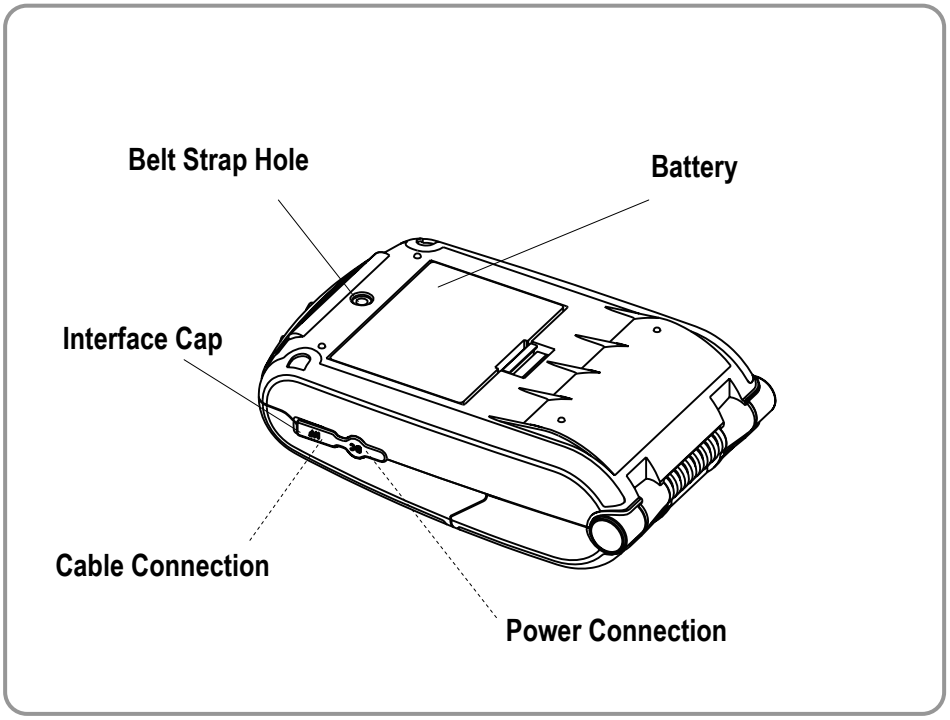


3-2-2-2 Feature Locations

1) Front



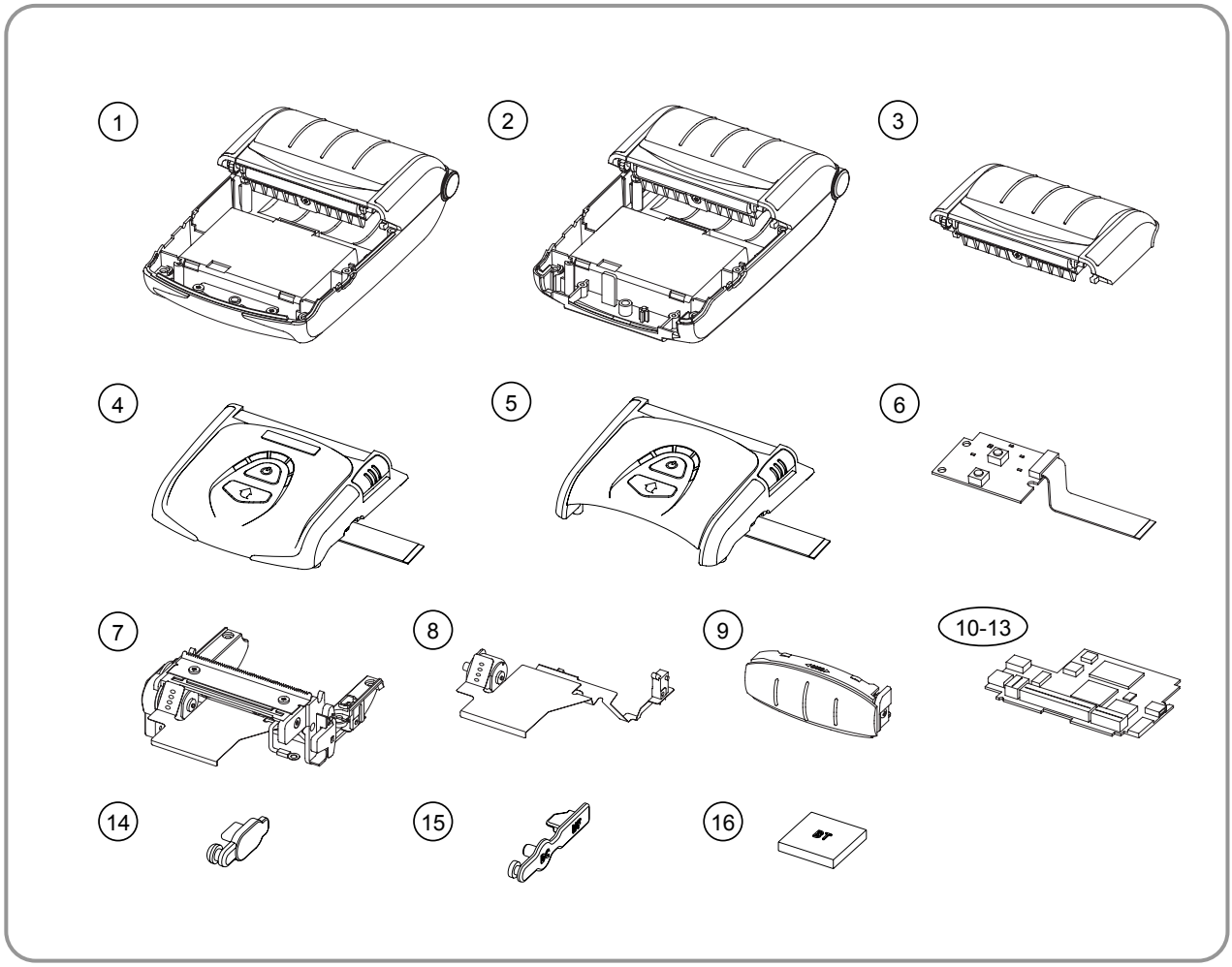

2) Rear



### 3-2-3 Other Component Specifications

| Item | | Description |
|---|---|---|
| TPH | Heat element structure | 2 heaters/dot |
| | Number of heat elements | 384 dots |
| | Heat element pitch | 8.0 dots/mm (0.125 mm pitch) |
| | Print width | 48 ± 0.2 mm |
| | Average resistance value ($R_{ave}$) | 176Ω ± 4 % |
| Motor | Voltage | 5.0 VDC ± 10% |
| | Current | 420 mA (Per phase) |
| | Phase | 4 Phase |
| | Exciting method | 2-2 Phase (Bipolar – Constant A) |
| | Exciting mode | Bipolar |
| | Step angle | 18° (2-2 Phase) |
| | Rotation | CW/CCW (Bi-direction) |
| 3 Track MSR head | Inductance | 80 mH ± 30 % |
| | DC resistance | 180 Ω ± 25 % |
| Bluetooth module | Bluetooth Specification | Version 2.0 +EDR |
| | Frequency | 2402 ~ 2480 MHz |
| | Modulation | 1M = GFSK<br>2M = ∏/4-DQPSK<br>3M = 8DPSK |
| | Transmission | GFSK = 721 kbps<br>∏/4-DQPSK = 1448.5 kbps<br>8DPSK = 2178.1 kbps |
| | Receive Sensitivity . | -80 dBm |
| | Maximum Output Power | +2 dBm |
| | Operating Voltage | 2.7 ~ 3.6 V |
| | Current Consumption | Maximum 39.1mA |
| | Operating Temperature | -30 ~ +70 ℃ |
| | Antenna Impedance | 50Ω |
| | Flash Memory | 8M bit |
| | Package Size | 11 x 11 x 1.6 mm |

## 3-3 Service Parts List



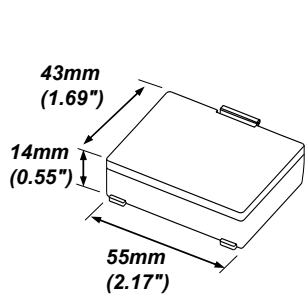

| No. | Model name | Description | Remark |
|---|---|---|---|
| 1 | P1002471 | KIT EM220 LWR HSG ASY NO MCR | |
| 2 | P1002472 | KIT EM220 LWR HSNG ASY W/MCR | |
| 3 | P1002473 | KIT EM220 MEDIA COVER ASSY | |
| 4 | P1002474 | KIT EM220 UPR CVR ASY NO MCR | |
| 5 | P1002477 | KIT EM220 UPPER CVR ASSY MCR | |
| 6 | P1002478 | KIT EM220 PCB CNTR & FFC ASY | |
| 7 | P1002479 | KIT EM220 PRINT MECH ASSY | |
| 8 | P1002481 | KIT EM220 MOTOR ASSY | |
| 9 | P1002482 | KIT EM220 MAG CARD REDR ASSY | |
| 10 | P1002508-001 | KIT EM220 "G" MAIN PCB ASSY<br>without MCR or BT function | |
| 11 | P1002508-002 | KIT EM220 "GM" MAIN PCB ASSY<br>with MCR function only | |
| 12 | P1002508-003 | KIT EM220 "BGM" MAIN PCB ASY<br>with MCR and BT function | |
| 13 | P1002508-004 | KIT EM220 "BG" MAIN PCB ASY<br>with BT function only | |
| 14 | P1006472 | KIT EM220 RUBBER CAP BT (5) | |
| 15 | P1006478 | KIT EM220 RUBBER CAP IF (5) | |
| 16 | P1006479 | KIT EM220 COVER BT CAN (5) | |

## 3-4 Accessories Specifications

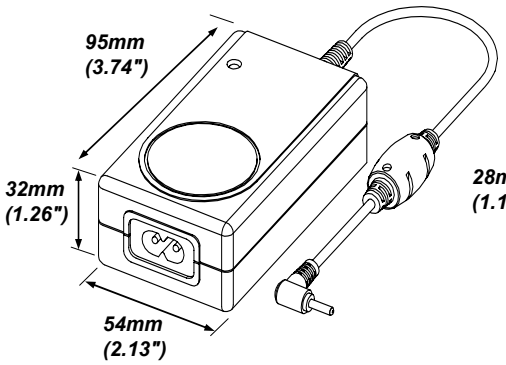
### 3-4-1 Accessories List

| No. | Model name | Description | Remark |
|---|---|---|---|
| 1 | P1002512 | Battery Pack | |
| 2 | P1002513 | Battery Charger | |
| | P1002513-1 | Battery Charger - US | |
| 3 | P1002514 | Battery Cradle | |
| 4 | P1002517 | Power Cord - US | |
| 5 | P1005085 | Power Cord - Japan | |
| 6 | P1002516 | Power Cord - EU | |
| 7 | P1002519 | Power Cord - AU | |
| 8 | P1004365 | Power Cord - CN | |
| 9 | P1004366 | Power Cord - AG | |
| 10 | P1002518 | Power Cord - UK | |
| 11 | P1002520 | Power Cord - KR | |
| 12 | P1006363 | Power Cord - BR | |
| 13 | P1002521 | IF Cable - Serial | |
| 14 | P1002522 | IF Cable - USB | |
| 15 | P1002523 | Leather Case | |
| 16 | P1002524 | Belt Strap | |
| 17 | - | Pen Cleaning | |
| 18 | P1002526 | Manual - CD | |
| 19 | P1004367 | Manual - Quick Start - AP | |
| 20 | P1004368 | Manual - Quick Start - World Wide | |
| 21 | P1002528 | Paper - Thermal Roll | |
| 22 | P1002527 | EM Series Quad Charger | |
| 23 | P1004374 | EM Series Quad AC/DC Adapter | |
| | P1004374-1 | EM Quad AC/DC Adapter - US | |
| 24 | P1004375 | Quad Power Cord - US | |
| 25 | P1005087 | Quad Power Cord - Japan | |
| 26 | P1004376 | Quad Power Cord - EU | |
| 27 | P1004377 | Quad Power Cord - AU | |
| 28 | P1004378 | Quad Power Cord - CN | |
| 29 | P1004379 | Quad Power Cord - AG | |
| 30 | P1004380 | Quad Power Cord - UK | |
| 31 | P1004381 | Quad Power Cord - KR | |
| 32 | P1006364 | Quad Power Cord - BR | |
| 33 | P1004382 | Quad Wall Mount | |

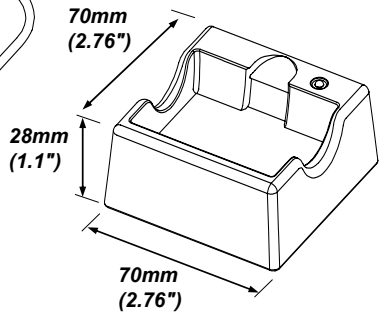
### 3-4-2 Accessories Appearance



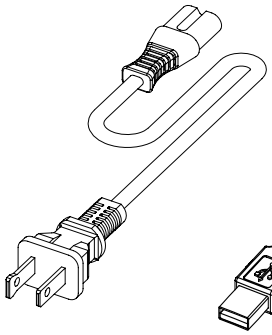

• Battery pack



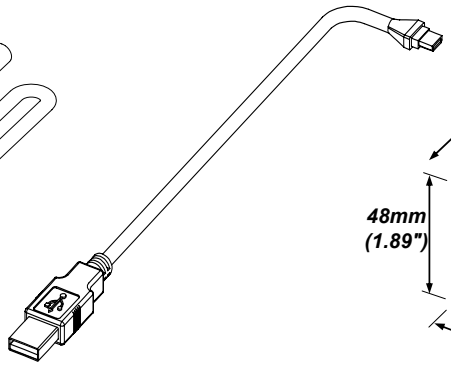

• Battery charger



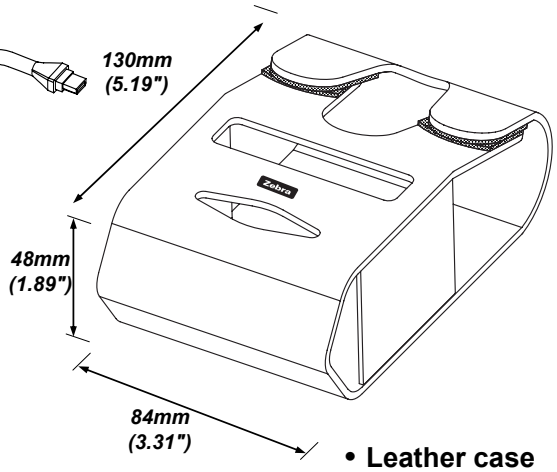

• Battery cradle



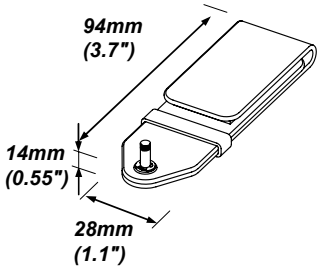
• Power Cord



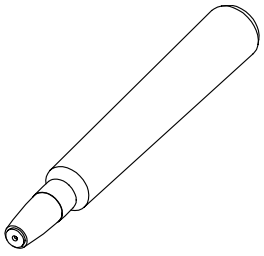
• Interface Cable




• Leather case

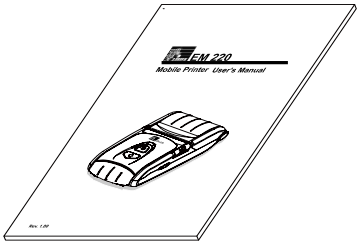



• Belt strap

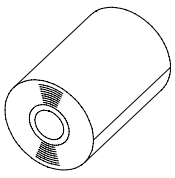


• Pen Cleaning

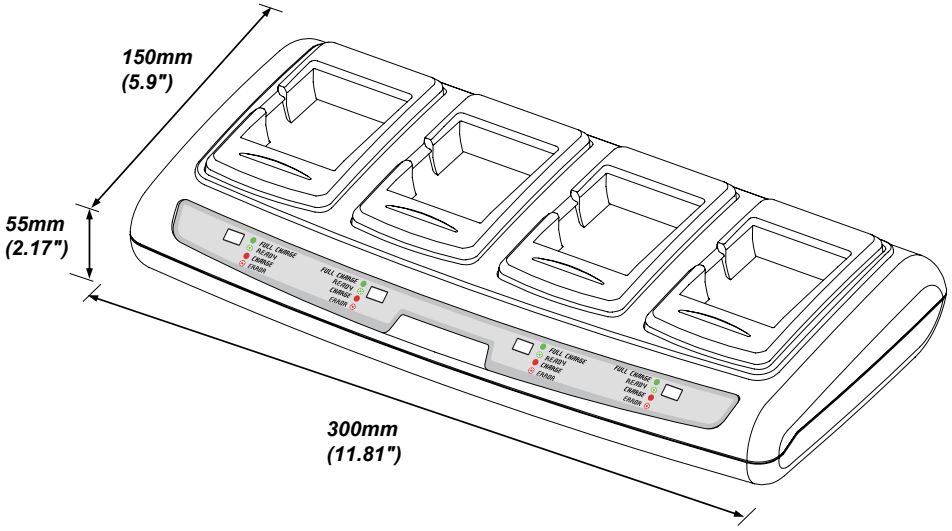
• Manual - CD



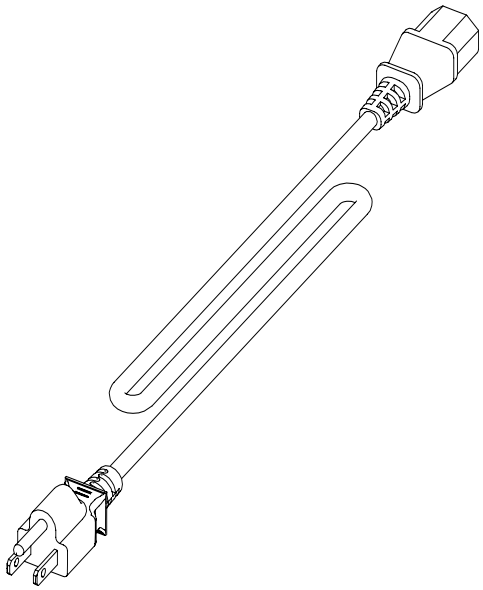

• Manual - Quick Start



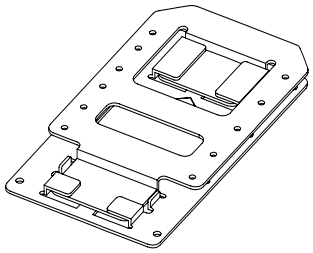
• Paper - Thermal Roll




• EM Series Quad charger



• Quad Power Cord



• Quad Wall Mount

### 3-4-3 P1002513 Battery charger

| Item | | Description |
|---|---|---|
| Input | Voltage | 100~250VAC |
| | Line frequency | 50 / 60Hz |
| | Current | 0.5A Max. at 110VAC input |
| Output | Battery type | Lithium ion 2 cell |
| | Charging voltage | 8.4VDC |
| | Charging current | 0.8A ± 10% |

### 3-4-4 P1002514 Battery cradle

| Item | | Description |
|---|---|---|
| Input | Charging voltage | 8.4VDC |
| | Charging current | 0.8A ± 10% |
| Output | Battery type | Lithium ion 2 cell |
| | Charging voltage | 8.4VDC |
| | Charging current | 0.8A ± 10% |

### 3-4-5 P1002512 Battery pack

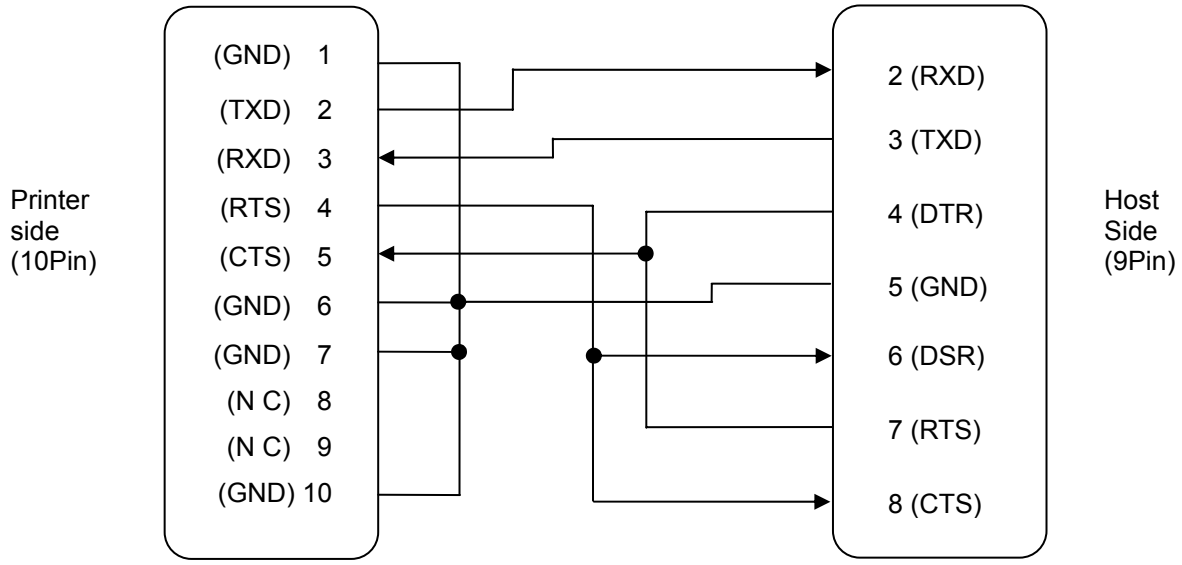
| Item | | Description |
|---|---|---|
| Input | Cell type | Lithium-ion |
| | Charging voltage | 8.4VDC |
| | Charging current | 0.8A ± 10% |
| | Charging time | 2.5 hours |
| Output | Voltage | 7.4VDC (Available 8.4~6.8VDC) |
| | Capacity | 1200 mAh |

### 3-4-6 P1002527 EM Series Quad charger

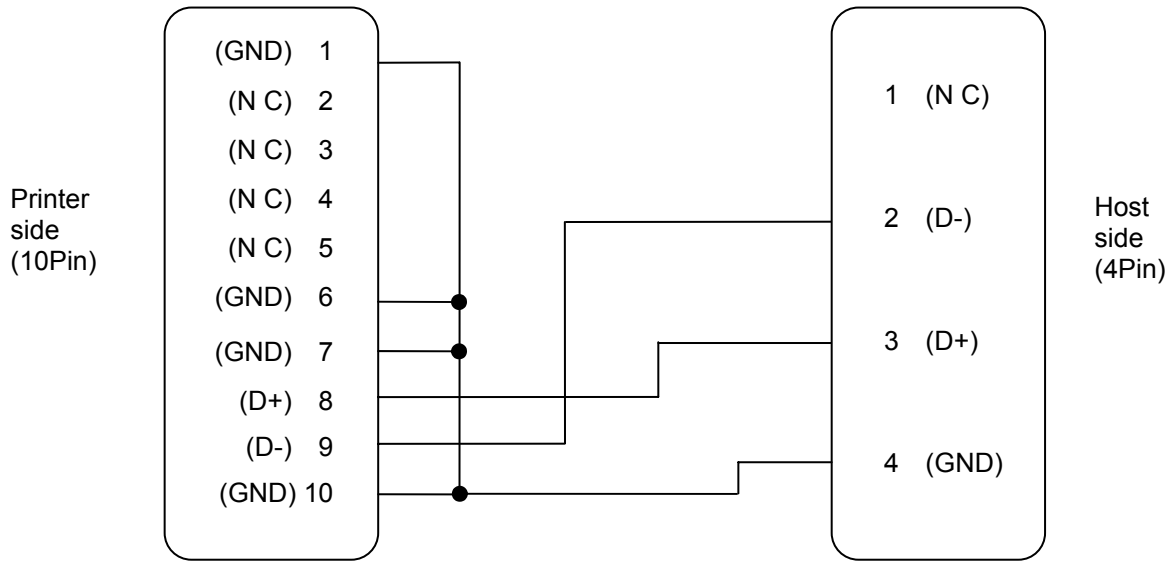
| Item | | Description |
|---|---|---|
| SMPS Input | Voltage | 100~240VAC |
| | Line frequency | 50 / 60Hz |
| | Current | 1.4A Max. at 110VAC input |
| SMPS Output & Quad charger Input | Voltage | 12VDC (± 10%) |
| | Current | 5A Max. at 12VDC input |
| Quad charger output | Charging voltage | 8.4VDC |
| | Charging current | 0.8A ± 10% |

**3-4-7 Interface cable for PC**

1) P1002521 Serial cable connection for PC



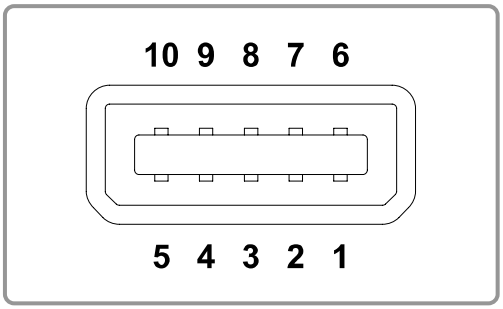

2) P1002522 USB cable connection for PC



3) Serial / USB signal descriptions

| Pin No. | Signal name | Direction | Function |
|---|---|---|---|
| 1 | GND | - | Ground |
| 2 | TXD | Output | Transmit data |
| 3 | RXD | Input | Receive data |
| 4 | nRTS | Output | Request to send<br>Set high when printer is ready to accept a command or data |
| 5 | nCTS | Input | Clear to send from host |
| 6 | GND | - | Ground |
| 7 | GND | - | Ground |
| 8 | D + | - | Differential data line |
| 9 | D - | - | Differential data line |
| 10 | GND | - | Ground |

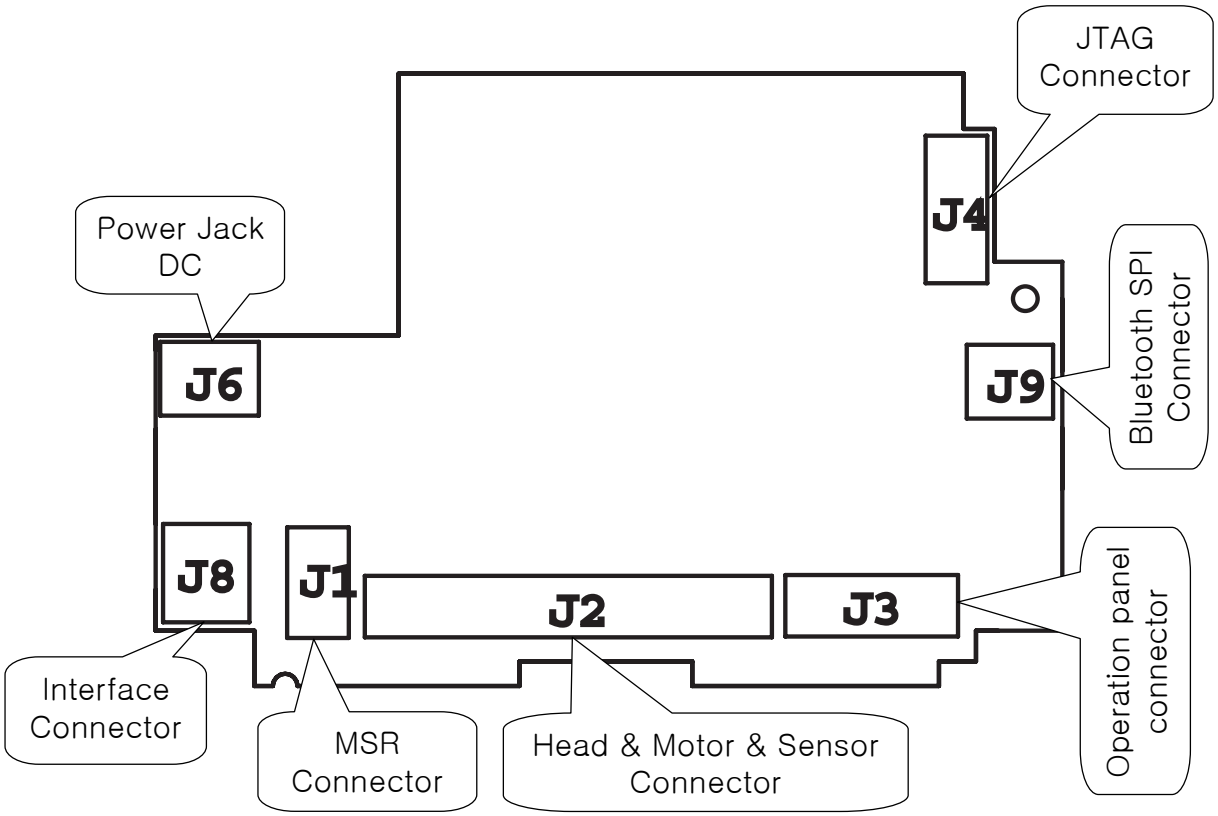
4) Serial / USB output connector



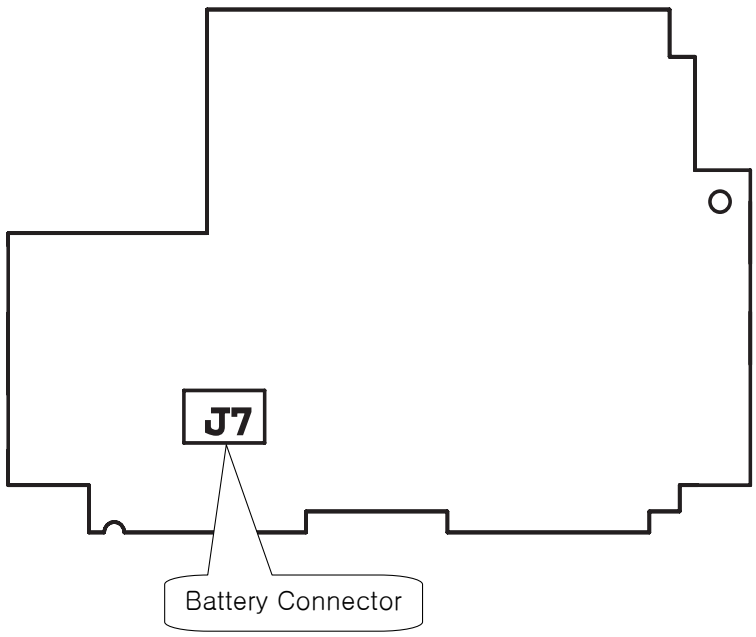
# 4. Hardware

## 4-1 Wiring diagram

1) Main board TOP wiring diagram



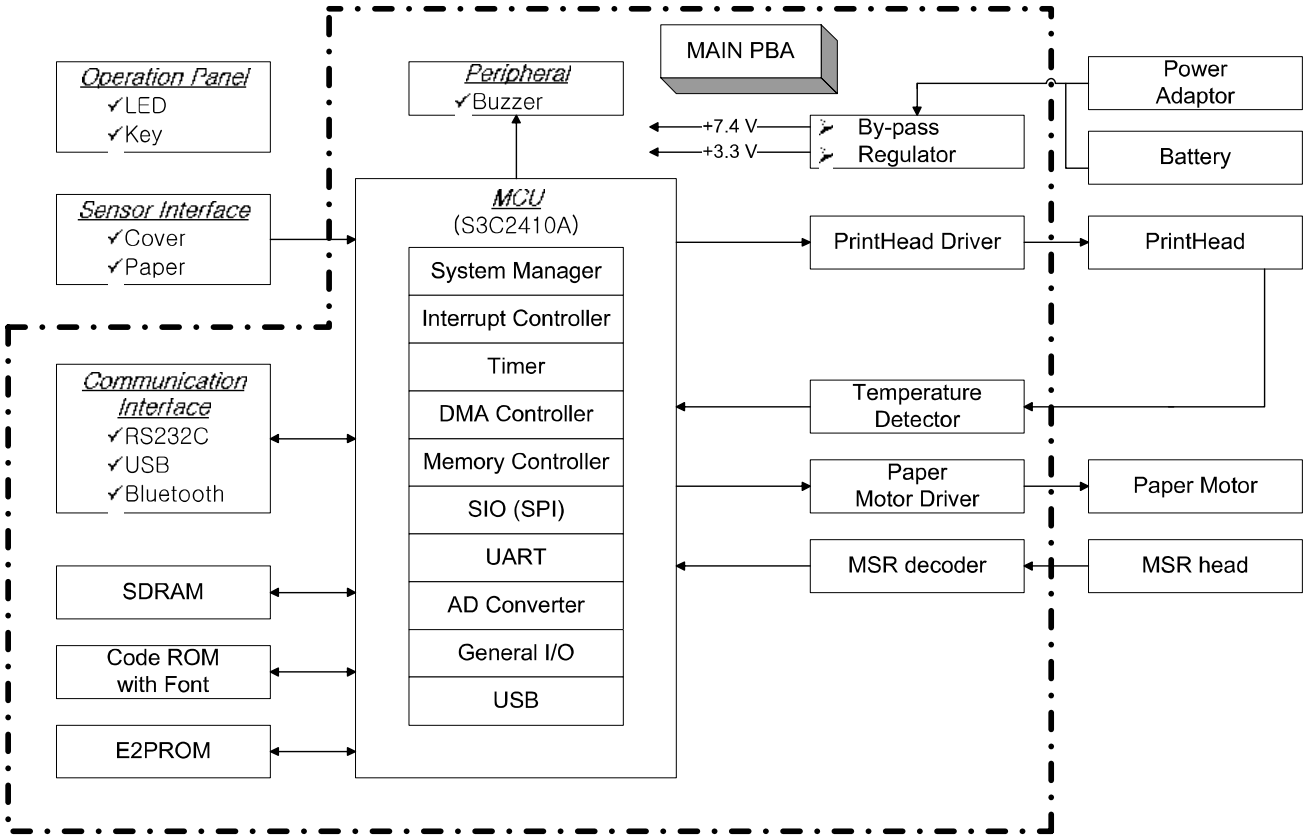
2) Main board BOTTOM wiring diagram




3) Interface Connector and Bluetooth SPI Connector

| Interface Connector | | | Bluetooth SPI Connector | | |
|---|---|---|---|---|---|
| **Pin No.** | **Function** | **Remark** | **Pin No.** | **Function** | **Remark** |
| 1 | GND | | 1 | VCC_3.3V | |
| 2 | TXD (Serial) | | 2 | BT_RST | |
| 3 | RXD (Serial) | | 3 | SPI_CLK | |
| 4 | nRTS (Serial) | | 4 | SPI_MOSI | |
| 5 | nCTS (Serial) | | 5 | SPI_CSB | |
| 6 | GND | | 6 | SPI_MISO | |
| 7 | GND | | 7 | GND | |
| 8 | D+ (USB) | | 8 | GND | |
| 9 | D- (USB) | | | | |
| 10 | GND | | | | |

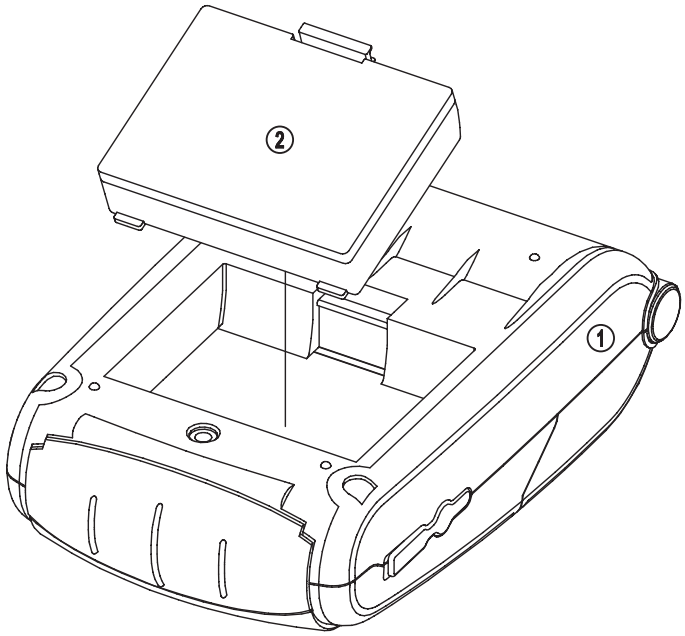
## 4-2 Block Diagram



# 5. Disassembly and Exploded view

## 5-1 Disassembly

### 5-1-1 Remove the Battery

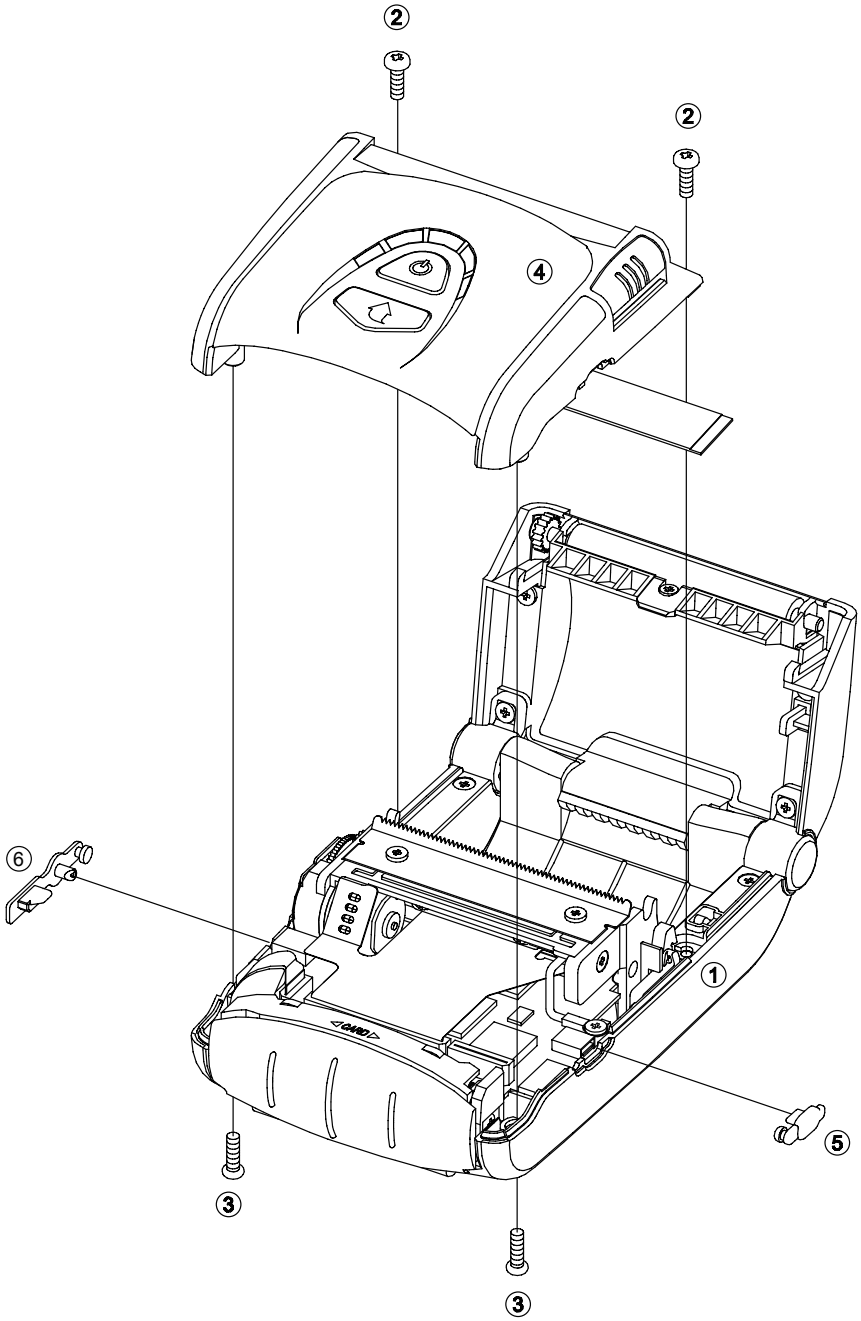



| Part name | Assembly procedure |
|---|---|
| (1) Cover lower-M<br>(2) Battery | 1) Remove the **(2) Battery** from the **(1) Cover lower-M**. |

***CAUTION***

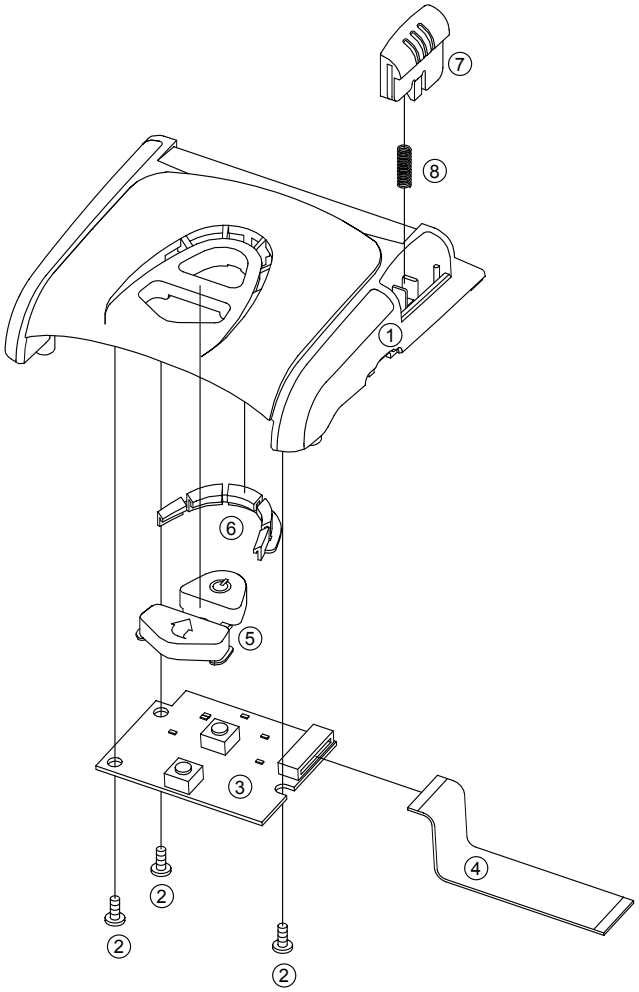
**The main PCB and FPC can be damaged severely if you disassemble the printer without removing the battery.**

**5-1-2 Remove the ASSY-cover upper**



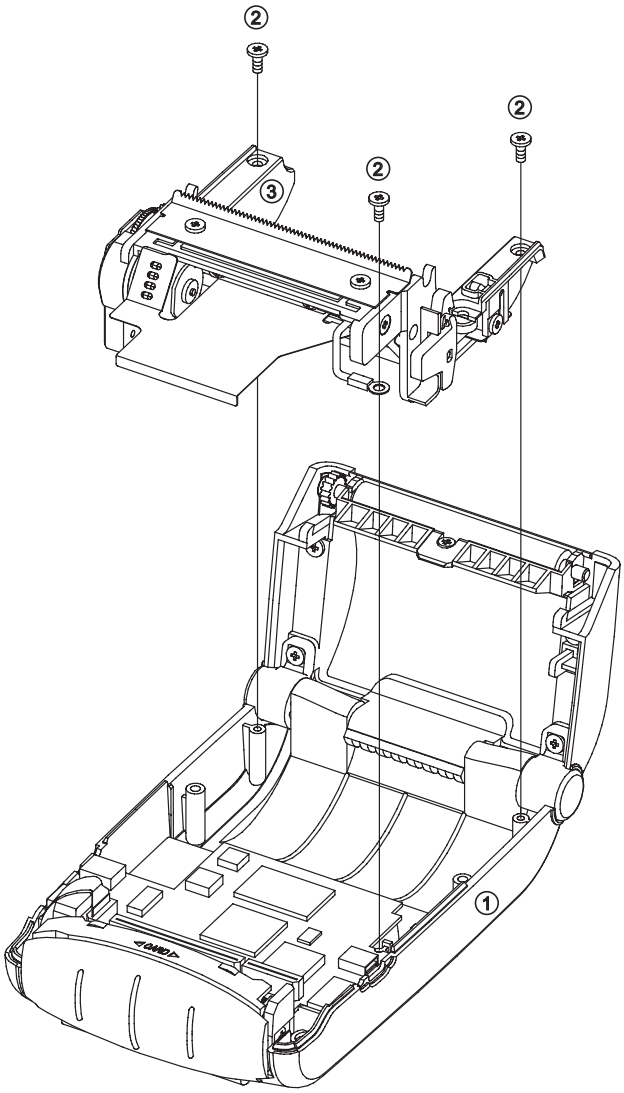

| Part name | Assembly procedure |
|---|---|
| (1) Cover lower-M<br>(2)(3) Screw<br>(4) Assy-cover upper-M<br>(5) Rubber-cap BT<br>(6) Rubber-cap IF | 1) Loosen four **(2)(3) Screw** from the **(1) Cover lower-M** and then remove the **(4) Assy-cover upper-M**.<br><br>2) Remove the **(5) Rubber-cap BT** and the **(6) Rubber-cap IF**. |

**5-1-3 Assy-cover upper**



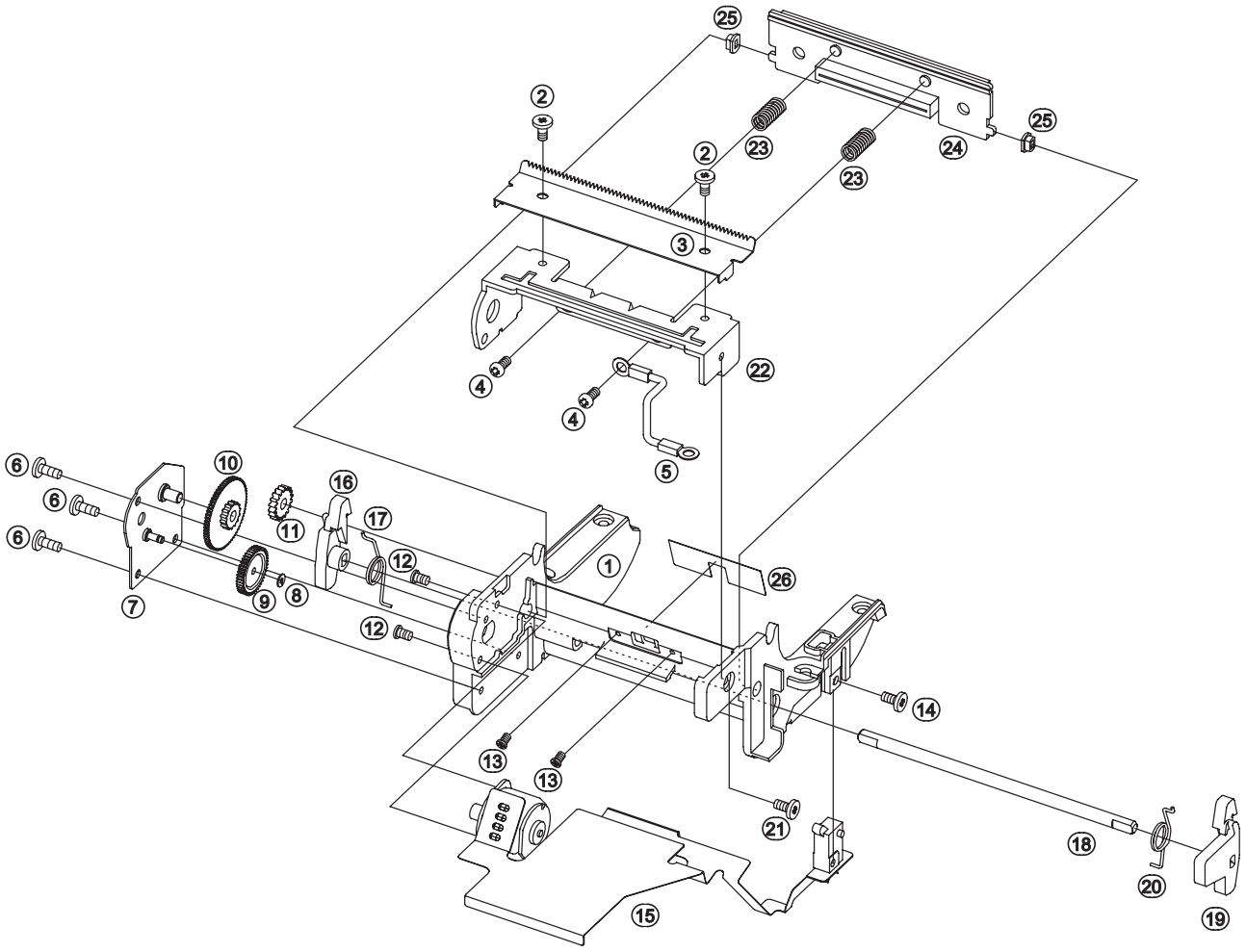

| Part name | Assembly procedure |
|---|---|
| (1) Cover lower-M<br>(2) Screw<br>(3) Assy-PCB-control | 1) Loosen three **(2) Screw** from the **(1) Cover upper-M** and then remove the **(3) Assy-PCB-control.** |
| (4) FFC<br>(5) Button control | 2) Remove the **(4) FFC** from the **(3) Assy-PCB-control**. |
| (6) Window LED<br>(7) Button open | 3) Remove the **(5) Button control** and the **(6) Window LED**. |
| (8) SP-button | 4) Remove the **(7) Button open** and then remove the **(8) SP-button**. |

**5-1-4 Remove the Assy-mechanism**



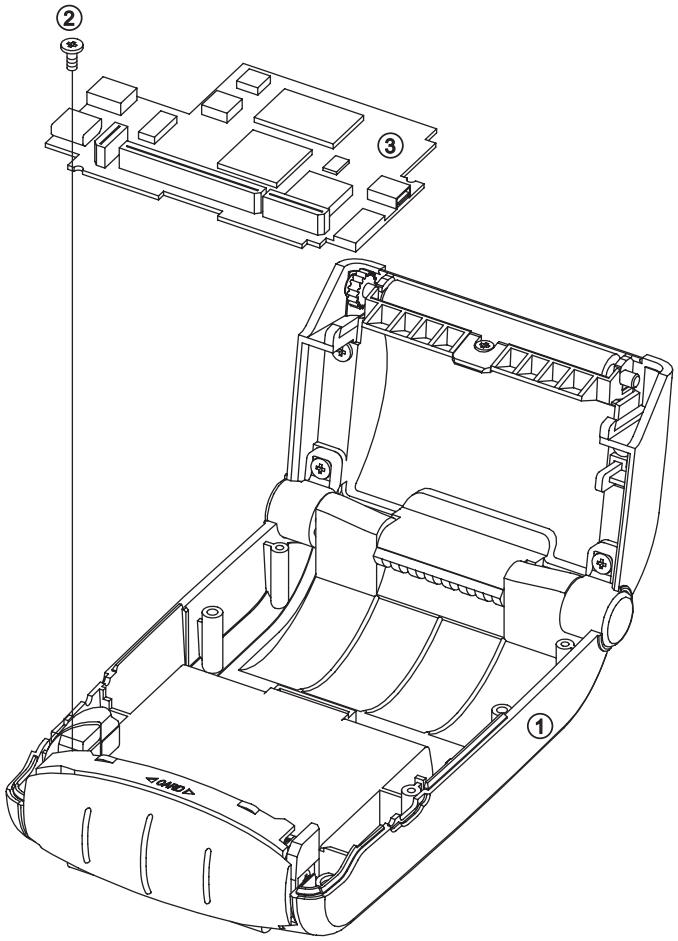

| Part name | Assembly procedure |
|---|---|
| (1) Cover lower-M<br>(2) Screw<br>(3) Assy-mechanism | 1) Loosen three **(2) Screw** from the **(1) Cover lower-M** and then remove the **(3) Assy-mechanism.** |

**5-1-5 Assy-mechanism**



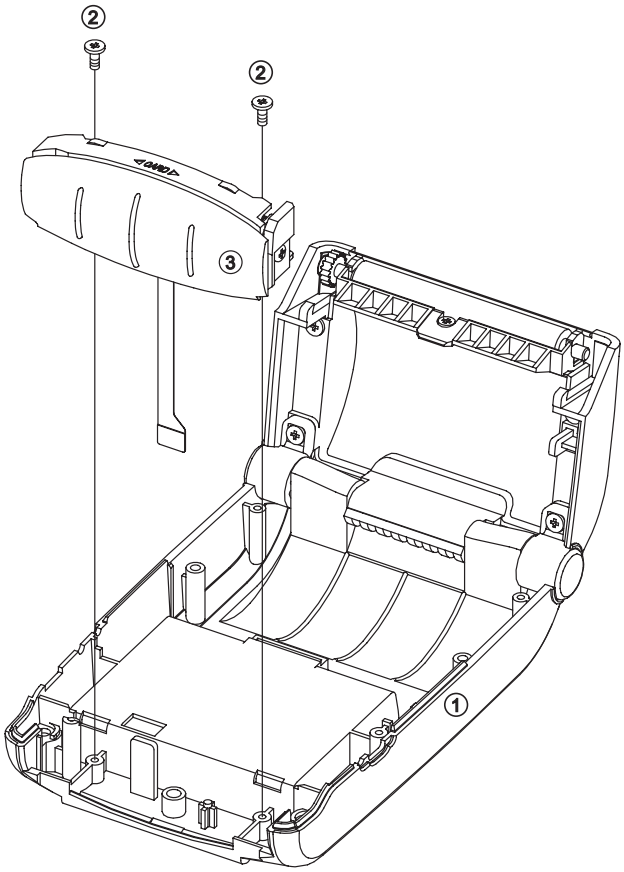

| Part name | Assembly procedure |
|---|---|
| (1) Basket paper<br>(2) Screw<br>(3) F-cutter manual | 1) Loosen two **(2) Screw** from the **(1) Basket paper** and then remove the **(3) F-cutter manual**. |
| (4) Screw<br>(5) Jumper cable | 2) Loosen two **(4) Screw** and then remove the **(5) Jumper cable**. |
| (6) Screw<br>(7) F-gear train | 3) Loosen three **(6) Screw** and then remove the **(7) F-gear train**. |
| (8) Washer<br>(9) Gear re-A<br>(10) Gear re-B<br>(11) Gear idle | 4) Remove the **(8) Washer**, the **(9) Gear re-A,** the **(10) Gear re-B** and the **(11) Gear idle**. |
| (12)(13)(14) Screw<br>(15) Assy-sub-FPC-main | 5) Loosen five **(12)(13)(14) Screw** and then remove the **(15) Assy-sub-FPC-main**. |
| (16) Arm locking-L<br>(17) SP-locking-L | 6) Remove the **(16) Arm locking-L** and then the **(17) SP-locking-L**. |
| (18) SH-locking<br>(19) Arm locking-R<br>(20) SP-locking-R | 7) Remove the **(18) SH-locking** and then remove the **(19) Arm locking-R** and the **(20) SP-locking-R**. |
| (21) Screw<br>(22) F-brkt motor<br>(23) SP-TPH | 8) Loosen the **(21) Screw** and the remove the **(22) F-brkt motor** and two (**23) SP-TPH**. |
| (24) Assy-TPH<br>(25) Bush-bracket | 9) Remove the **(24) Assy-TPH** and then remove two **(25) Bush-bracket**. |
| (26) Lable-hot | 10) Remove the **(26) Label-hot**. |

**5-1-6 Remove the Assy-PCB-main**



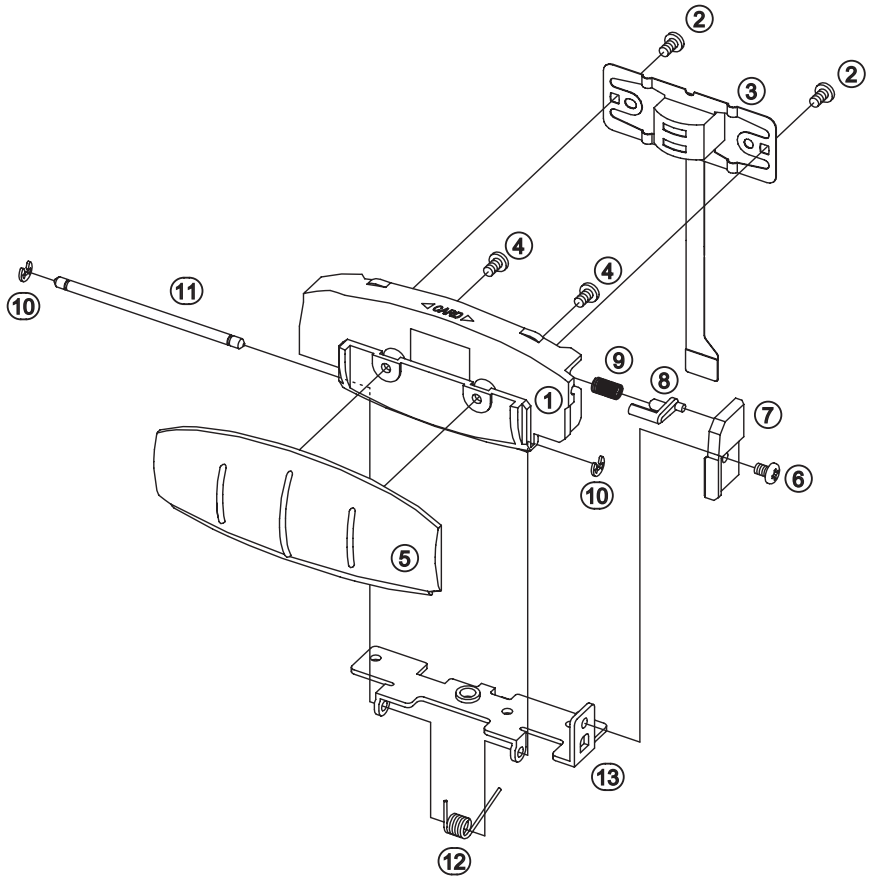

| Part name | Assembly procedure |
|---|---|
| (1) Cover lower-M<br>(2) Screw<br>(3) Assy-PCB-main | 1) Loosen the **(2) Screw** from the **(1) Cover lower-M** and then remove the **(3) Assy-PCB-main.** |

**5-1-7 Remove the Assy-MSR**



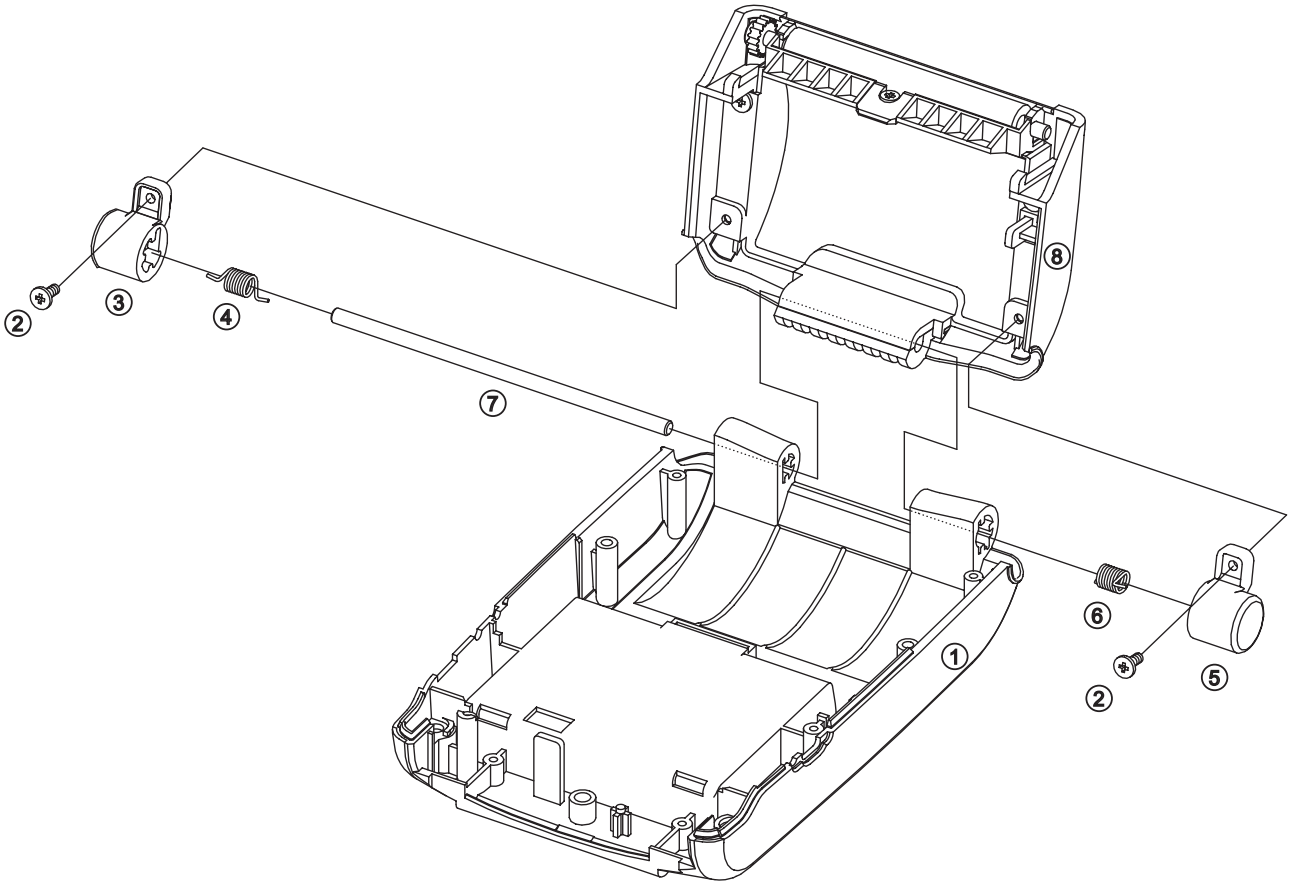

| Part name | Assembly procedure |
|---|---|
| (1) Cover lower-M<br>(2) Screw<br>(3) Assy-MSR | 1) Loosen two **(2) Screw** from the **(1) Cover lower-M** and then remove the **(3) Assy-MSR.** |

**5-1-8 Assy-MSR**



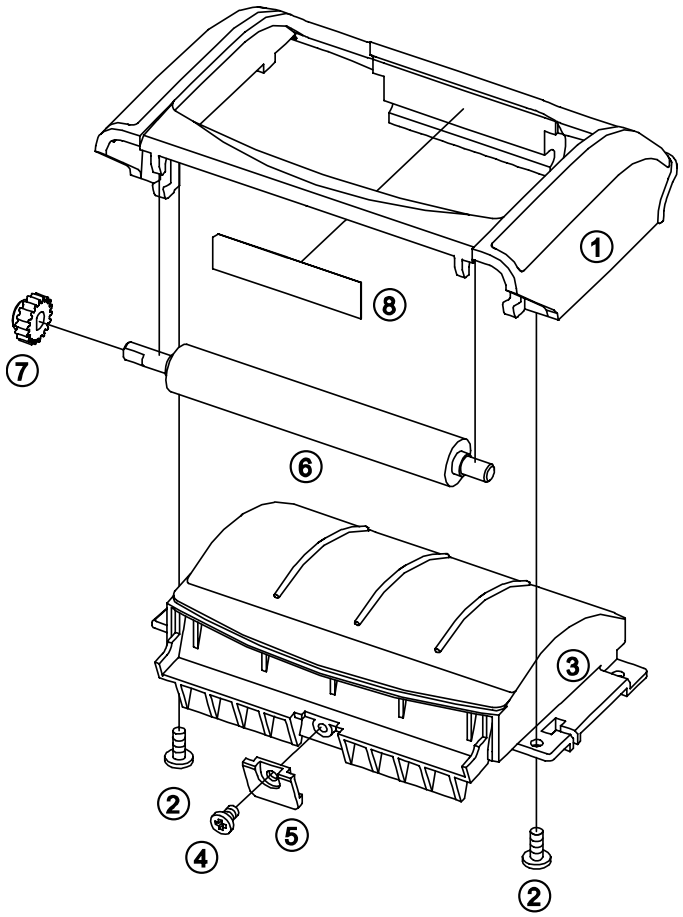

| Part name | Assembly procedure |
|---|---|
| (1) Housing MSR<br>(2) Scrw<br>(3) Head MSR<br>(4) Screw<br>(5) Cover MSR<br>(6) Screw<br>(7) Housing toggle<br>(8) Arm toggle<br>(9) SP-toggle<br>(10) E-ring<br>(11) SH-MSR<br>(12) SP-MSR<br>(13) F-MSR | 1) Loosen two **(2) Screw** from the **(1) Housing MSR** and then remove the **(3) Head MSR**.<br><br>2) Loosen two **(4) Screw** and then remove the **(5) Cover MSR**.<br><br>3) Loosen the **(6) Screw** and then remove the **(7) Housing toggle, (8) Arm toggle** and **(9) SP-toggle**.<br><br>4) Remove two **(10) E-ring** and then remove the **(11) SH-MSR**, the **(12) SP-MSR**, the **(13) F-MSR**. |

**5-1-9 Remove the Assy-cover lower**




| Part name | Assembly procedure |
|---|---|
| (1) Cover lower-M<br>(2) Screw<br>(3) Holder pivot-L<br>(4) SP-pivot-L<br>(5) Holder pivot-R<br>(6) SP-pivot<br>(7) SH-pivot<br>(8) Assy-cover paper | 1) Loosen two **(2) Screw** from the **(1) Cover lower-M** and then remove the **(3) Holder pivot-L** and the **(4) SP-pivot-L**<br><br>2) Remove the **(5) Holder pivot-R** and then remove the **(6) SP-pivot** then<br><br>3) Remove the **(7) SH-pivot** and then remove the **(8) Assy-cover paper**. |

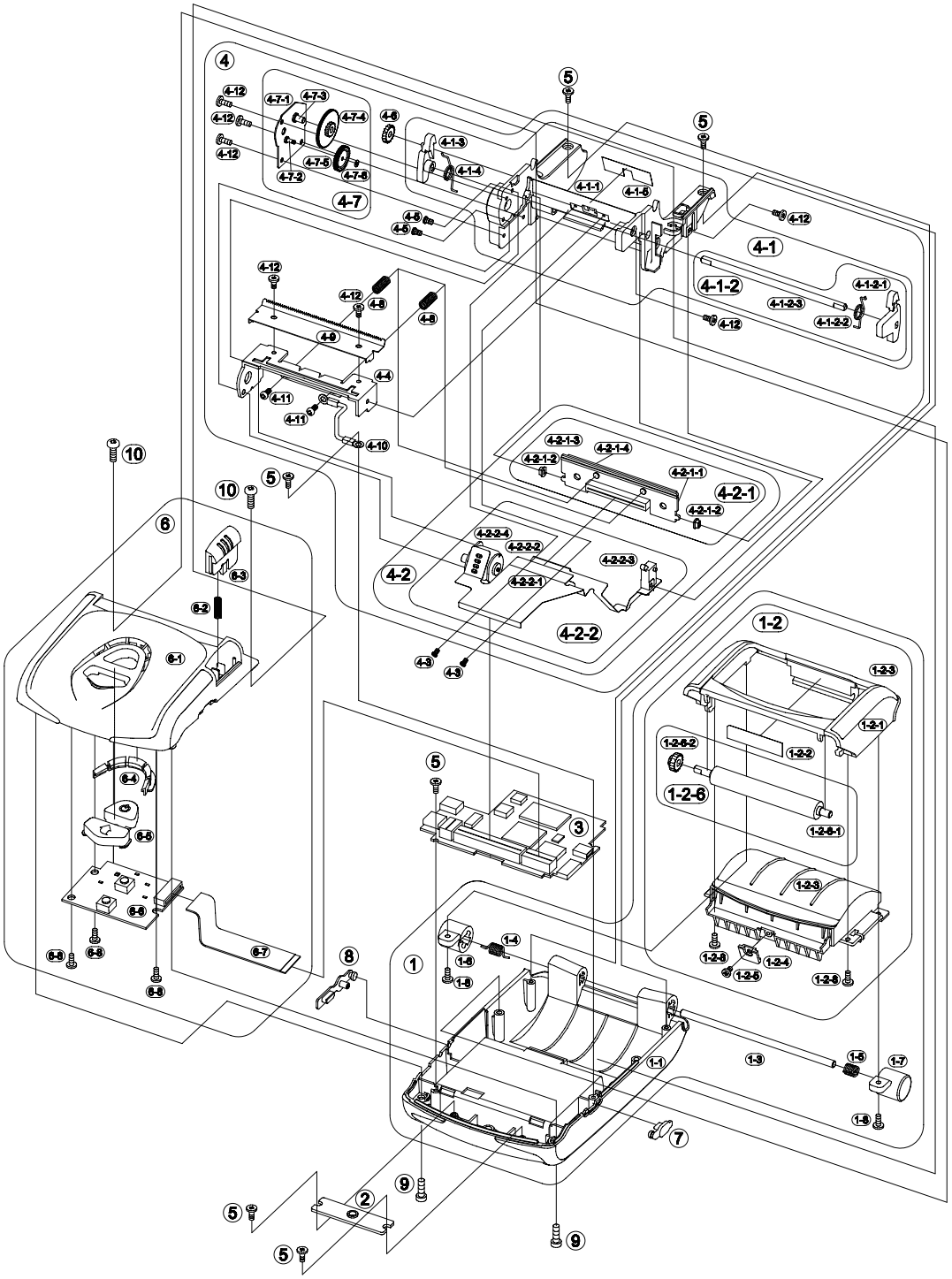
**5-1-10 Assy-cover paper**



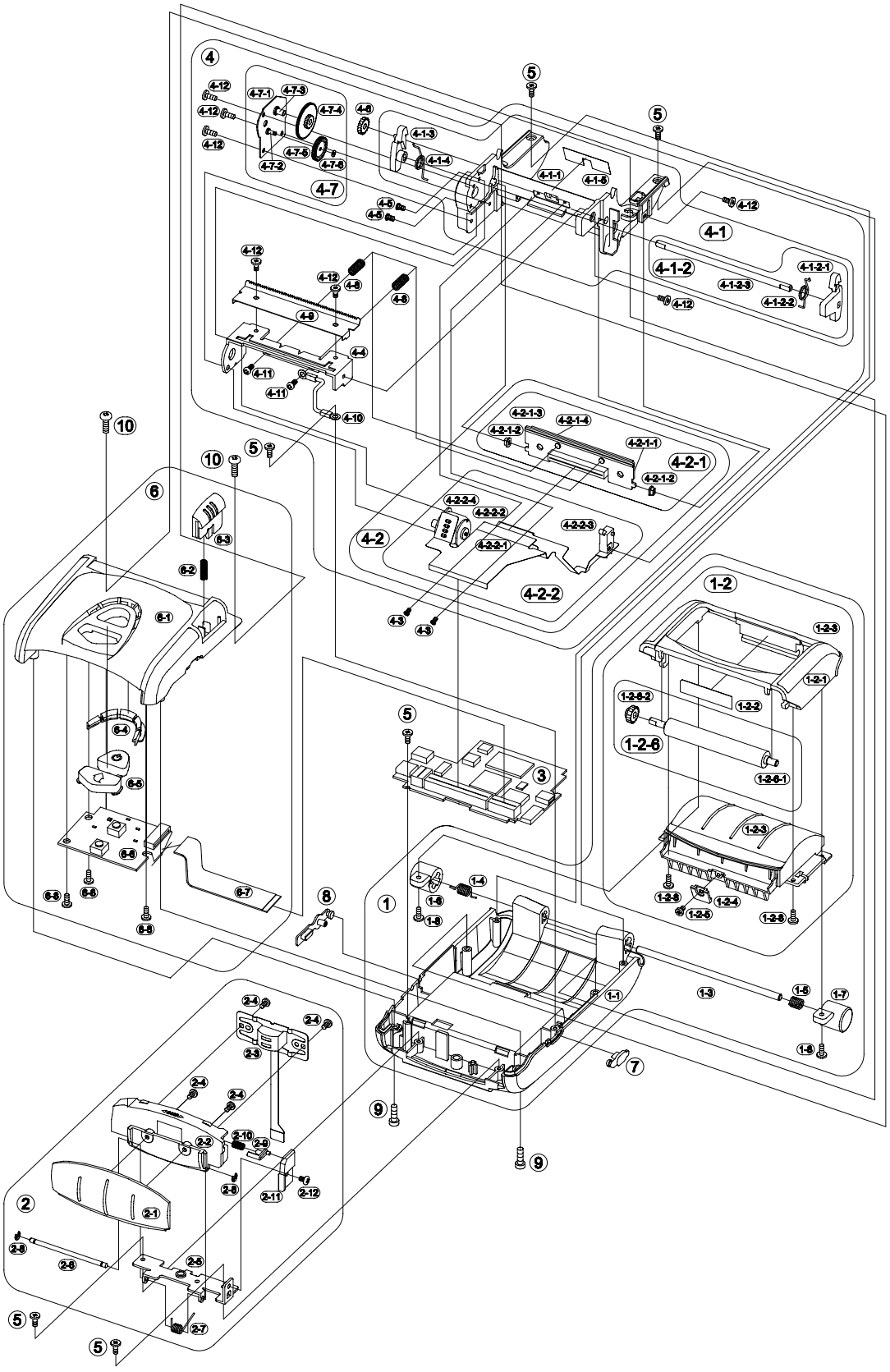

| Part name | Assembly procedure |
|---|---|
| (1) Cover paper<br>(2) Screw<br>(3) Window paper | 1) Loosen two **(2) Screw** from the **(1) Cover paper** and then remove the **(3) Window paper**. |
| (4) Screw<br>(5) Protector PE | 2) Loosen the **(4) Screw** and then remove the **(5) Protector PE.** |
| (6) SH-rubber roller<br>(7) Gear feeding | 3) Remove the **(7) Gear feeding** from the **(6) SH-rubber roller**. |
| (8) Label-paper | 4) Remove the **(8) Label-paper** |

## 5-2 Exploded view

### 5-2-1 EM 220 without MSR



**5-2-2 EM 220M with MSR**



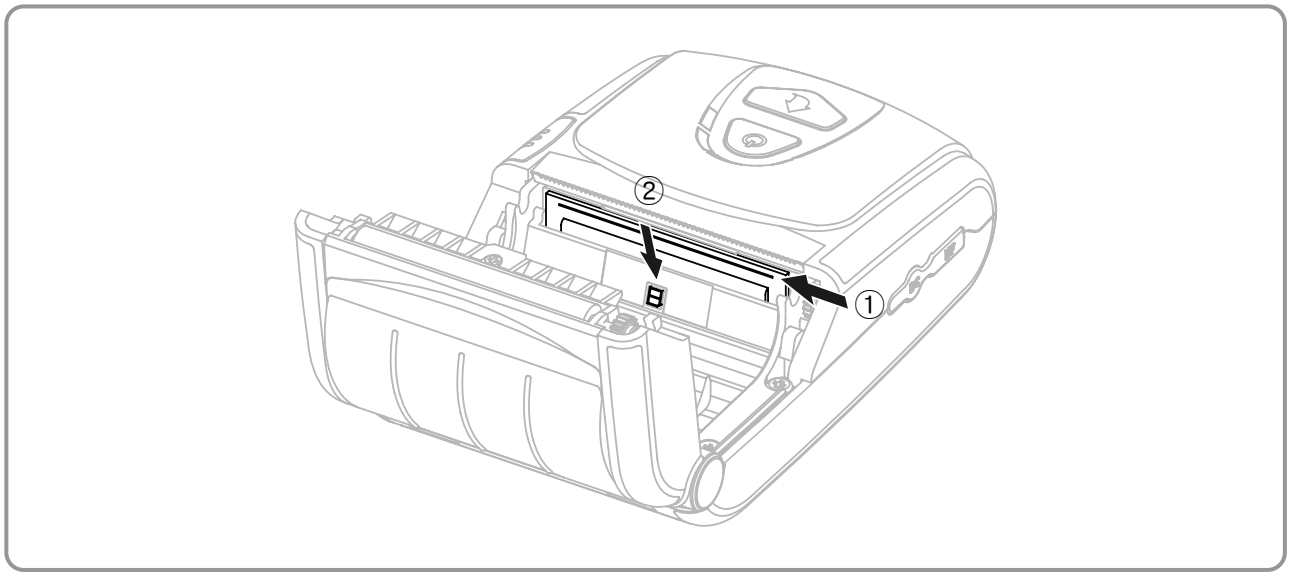
# 6. Adjustments and Maintenance

## 6-1 Printer Cleaning

If the interior of the printer is dusty, print quality can decline.
In such a case, follow the instructions below to clean the printer.

***CAUTION***

- Make sure to turn the printer power off prior to cleaning.
- The print head gets very hot during printing. Before cleaning the print head, turn the printer power off and wait approximately 10 minute before commencement.
- When cleaning the print head, do not to touch the heated portion of the print head. (The print head is susceptible to damage from static electricity, etc.)
- Do not allow the print head to become scratched and/or damaged in any way.




1) Open the paper cover and remove any paper that may be present.

2) Wipe the print head ① with a cleaning pen.

3) Use a cloth moistened with an alcohol solution to clean the paper sensor ② and remove any paper remnants and/or dust.

4) Insert paper into the printer 1~2 minutes after completing the cleaning process and close the printer cover.

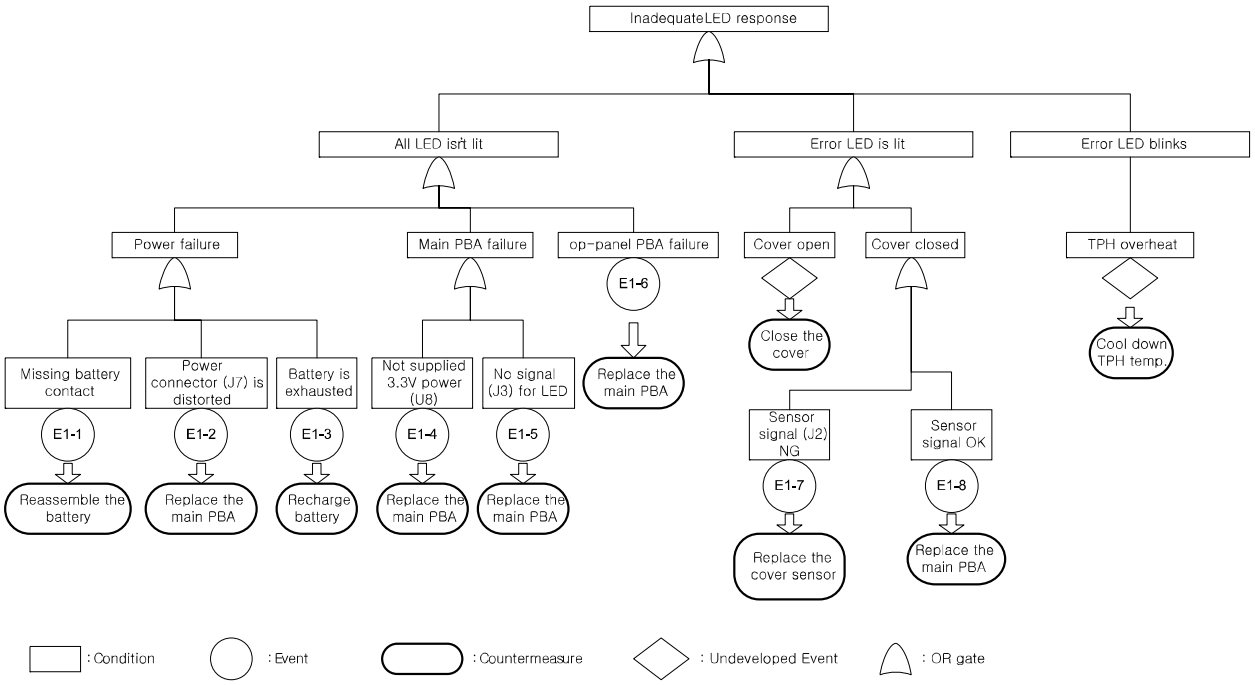
# 7. Troubleshooting

Every undesired outcome can be investigated with fault tree analysis which is one of RCA (Root Cause Analysis). Fault tree analysis is a graphical representation of the major faults or critical failures associated with a product, the causes for the faults, and potential countermeasures. This way user can identify possible causes easily.

There are six undesired outcome, divided by symptom category :

- Inadequate LED response
- Printing trouble
- MSR operation
- Diagnostic (self-test / hexa-decimal dump)
- Communication interface

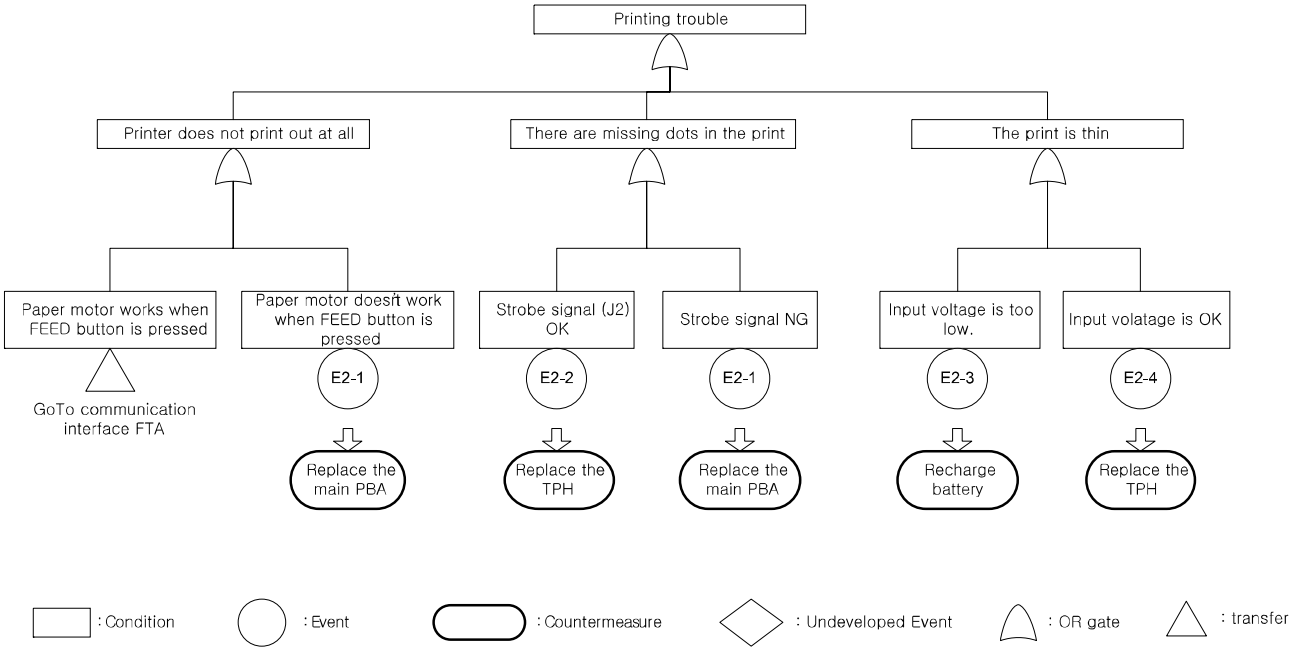
## 7-1 Inadequate LED response




E1-1 : Poor insert battery E1-2 : Poor parts E1-3 : Discharged battery E1-4 : Regulator failure

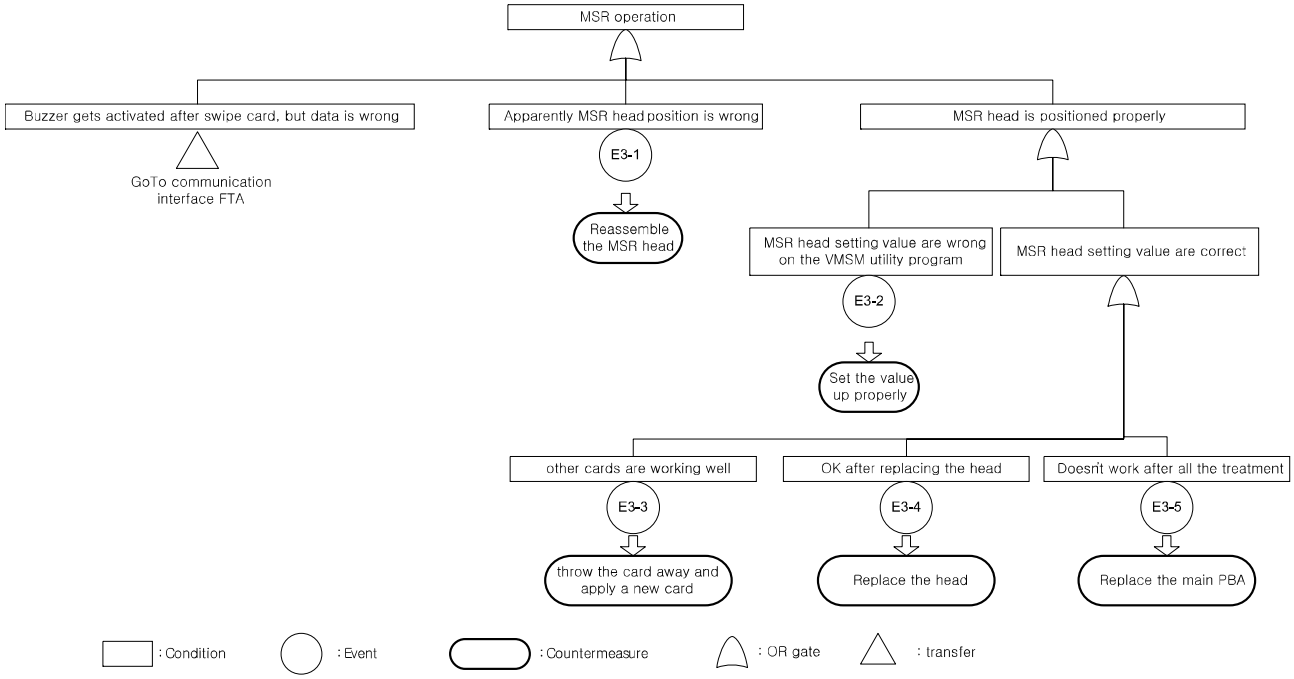
E1-5 : MCU failure E1-6 : Poor E1-7 : Cover open sensor failure E1-8 : MCU failure

## 7-2 Printing trouble



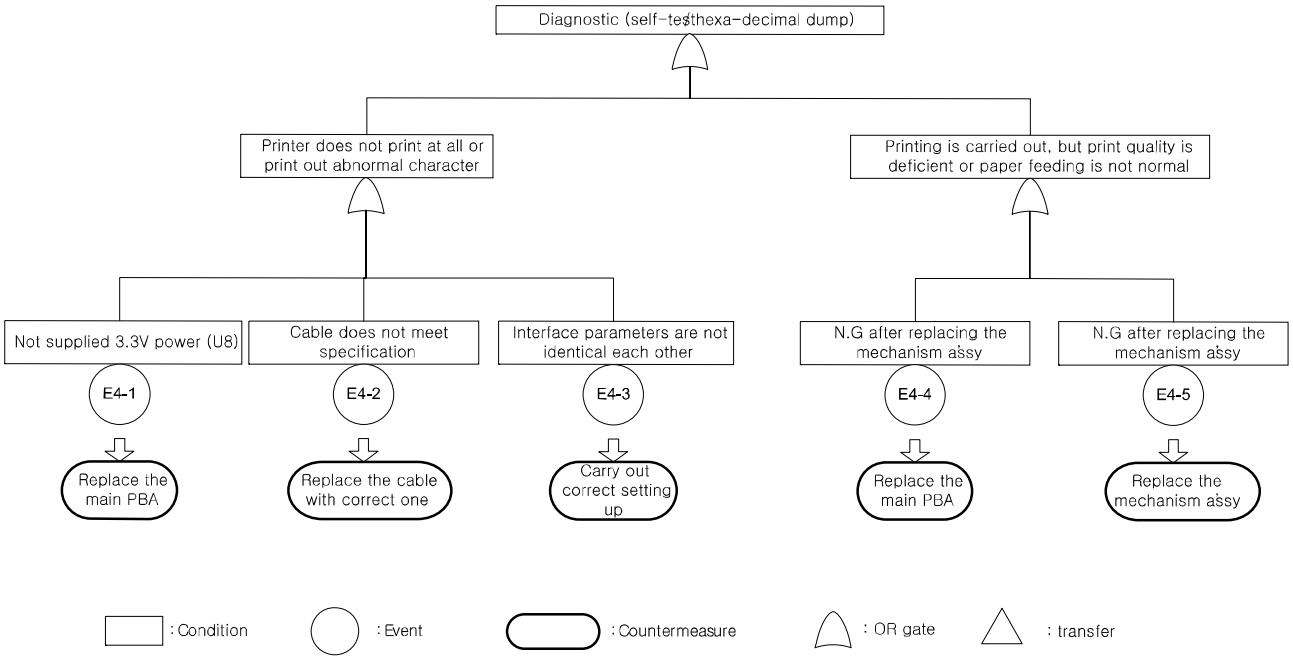

E2-1 : MCU failure E2-2 : TPH failure E2-3 : Battery is almost exhausted E2-4 : TPH becomes aged

## 7-3 MSR operation



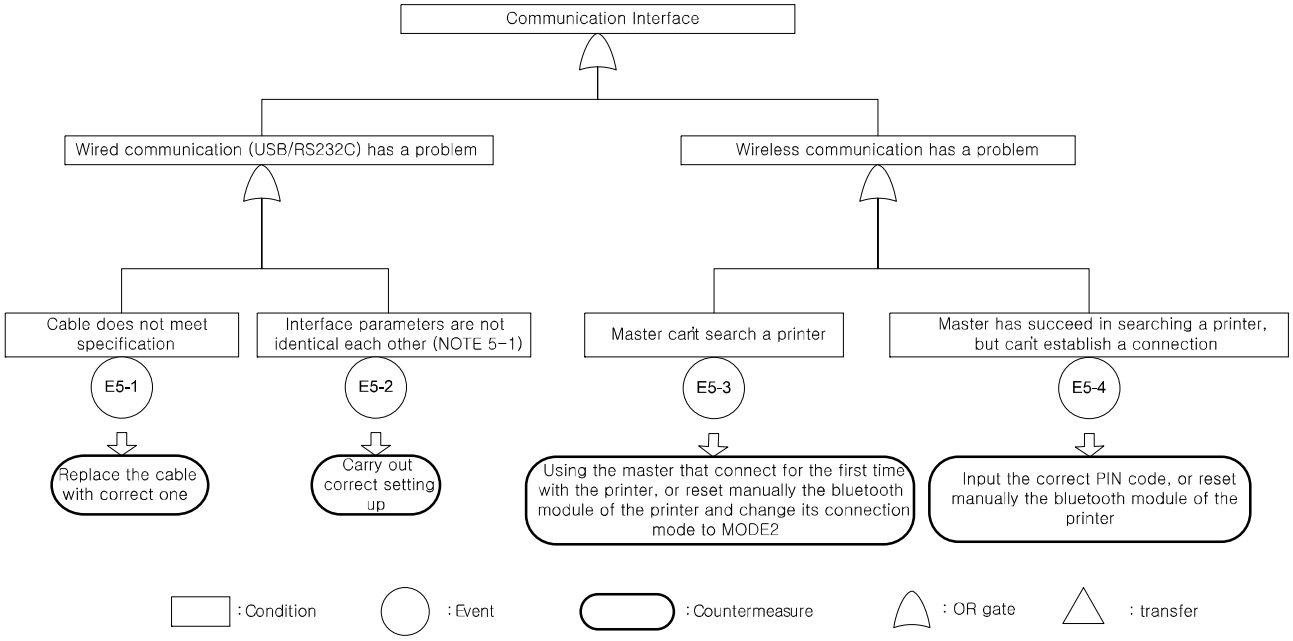

E3-1 : Poor MSR head of assembly E3-2 : Wrong setting value E3-3 : Card failure E3-4 : MSR head failure
E3-5 : Main PBA failure

# 7-4 Diagnostic (self-test / hexa-decimal dump)




E4-1 : Regulator failure E4-2 : Mistake for choosing a cable E4-3 : Failure in the setting up parameter E4-4 : Main PBA failure
E4-5 : Mechanism ass'y failure

## 7-5 Communication Interface




NOTE 5-1 : There are 3-kind cable in RS232C.
1) TTL-level : 3.3 V
2) TTL-level : 5 V
3) RS-232C level

E5-1 : Mistake for choosing a cable

E5-2 : Failure in the setting up parameter

E5-3 : Rejected by security (connection mode 1)

E5-4 : Rejected by security (invalid PIN code)